EUROPEAN COMMISSION

# THERMIE

## DEMONSTRATION OF ENERGY TECHNOLOGY

### ACTIVITY REPORT 1998

JOULE-THERMIE Programme

Directorate General for Energy (DG XVII)

**Published by the EUROPEAN COMMISSION**

**Directorate-General XVII Energy / B-1049 Brussels**

**LEGAL NOTICE**

A great deal of additional information on the European Union is available on the Internet. It can be accessed through the Europa server (http://europa.eu.int).

Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use which might be made of the following information

Cataloguing data can be found at the end of this publication.

Luxembourg: Office for Official Publications of the European Communities, 1998

ISBN 92-828-5650-X

© European Communities, 1998

Reproduction is authorised provided the source is acknowledged.

*Printed in Belgium*

# THERMIE

DEMONSTRATION OF ENERGY TECHNOLOGY

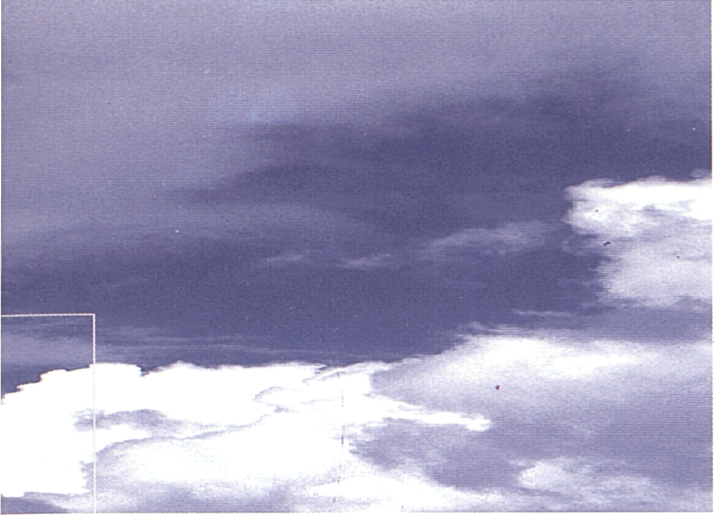
ACTIVITY REPORT 1998

# CONTENTS

# FOREWORD

With the ending of this past year, the current JOULE-THERMIE Programme (1995-1998) was brought to a close. This initiative, designed to support new, clean and efficient non-nuclear energy technologies from R&D through to demonstration and market penetration, has achieved much in the way of progress. This, our third Activity Report, builds upon the messages from the previous two documents to highlight the totality of the successes throughout the four years of activities.

During the course of the Programme, our actions have been driven by three major objectives. First, a very real need, caused by concerns about the potential scarcity of resources, to improve the security of the European Union's energy supply. Second, the necessity to protect both our global and local environments from the threat of climate change and other forms of environmental damage. Third, a wish to contribute to improving the competitiveness of our industries and the daily lives of our citizens in the EU and beyond.



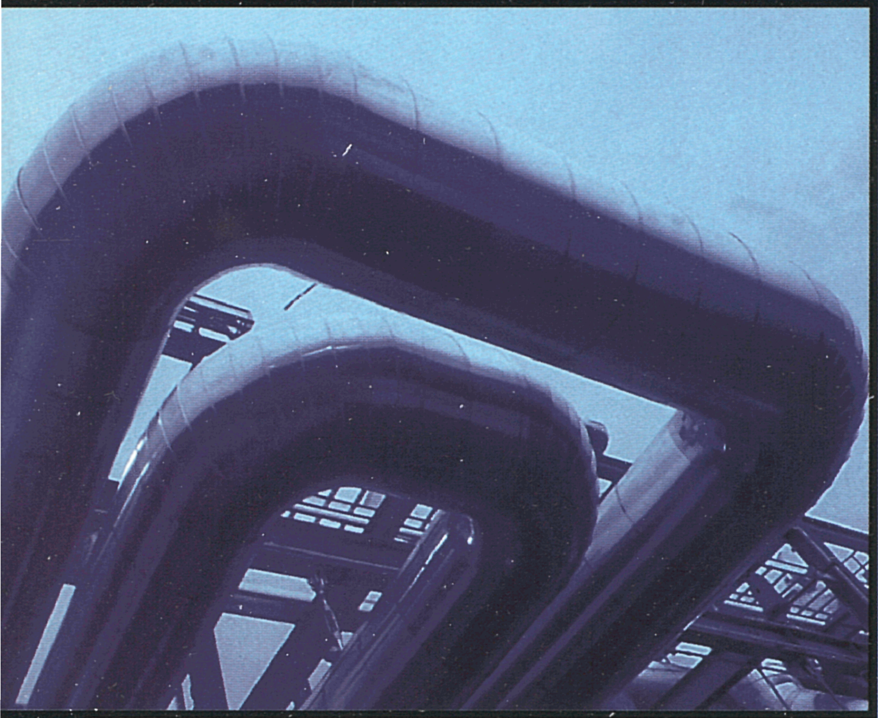
Much has been achieved towards meeting these objectives, but much remains to be done. That is why we in the European Commission must continue to support the research and technological development (RTD) of new energy technologies. Moreover, by focusing not only on the technology itself, but also on the services it can deliver, we can ensure that our actions, and those of our partners in the projects, help meet the real needs of our industries and of society at large. We must also ensure that our activities in RTD are integrated with our other energy-related initiatives, such as SAVE, SYNERGY and ALTENER, and with the Community's more global policy objectives.

A reflection on the past year would very clearly bring to the reader's mind the climate-related disasters in Central America, and the efforts of the international community at the meeting in Buenos Aires to address the question of climate change. Moreover, the severe economic problems in the Far East, and the subsequent impacts on our own economies, remind us that the world truly is a global village.

That is why, as we move towards the third millennium, we must help build a bridge which brings forward the results from the past and helps meet the requirements of a new era. The role of an initiative to demonstrate the benefits of new energy technologies, and encourage their uptake, remains vital. We will continue to learn from our past activities and adapt to a new reality.

I am very pleased, therefore, to introduce this final review of our activities within THERMIE for the year 1998. With this, our third Activity Report, the impacts of our Programme are becoming more and more apparent. I am delighted to be able to highlight a few of them here, and trust you will find it compelling reading.

Christos Papoutsis
Member of the Commission



# EXECUTIVE SUMMARY

THIS ANNUAL REPORT SUMMARISES THE WIDE RANGE OF ACTIVITIES OF THERMIE AND HIGHLIGHTS THEIR BENEFITS IN ENCOURAGING A WIDER MARKET DEVELOPMENT AND PENETRATION OF NEW, CLEAN AND EFFICIENT ENERGY RESOURCES. A SUBSTANTIAL AMOUNT OF RESOURCES HAS BEEN INVESTED BY THE COMMISSION IN PARTNERSHIP WITH THE ORGANISATIONS CARRYING OUT THE PROJECTS.

These resources have directly and indirectly stimulated welcome impacts at a number of levels. Firstly, the projects have had valuable impacts at the level of the firm for the different types of participating companies, by encouraging innovation, helping improve competitiveness of operations, disseminating knowledge, creating market awareness, networking etc.

Secondly the Programme, through its complementary sets of demonstration projects and associated measures aimed at replication, has contributed to the wider objectives of the European Union in terms of protecting our environment, stimulating growth and encouraging employment generation.

Finally, at a strategic technological level, the Programme and its actions have pushed forward the state-of-the-art and advanced the boundaries of our understanding of new systems and applications. By linking technical demonstration projects with dissemination and promotion, THERMIE has played a pivotal role in bringing new ideas into the mainstream, to provide the clean, economical and quality services that our industries and citizens require.

THERMIE activities during 1998 have provided some valuable lessons and access to important experience and knowledge of new, clean and efficient energy technologies and applications.

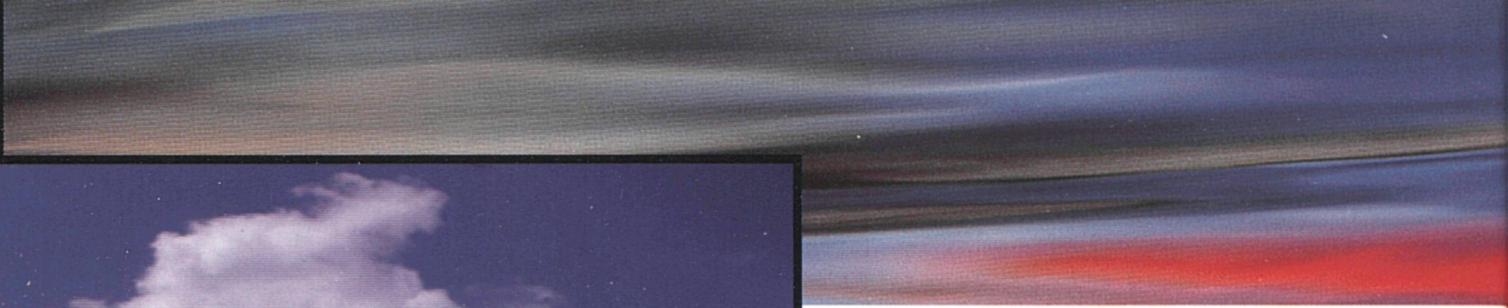
The Commission, in its document "Inventing Tomorrow", has recognised the need to go further, to provide real-time solutions to the changing needs of our industry and our society as a whole. As the debate on the new plans for the Fifth Framework Programme for RTD comes to a close, it is clear that the societal demand for the new themes and objectives is increasing. These will be built upon the technological development of the past, by bringing our activities ever more closer to meeting the real needs of our citizens.

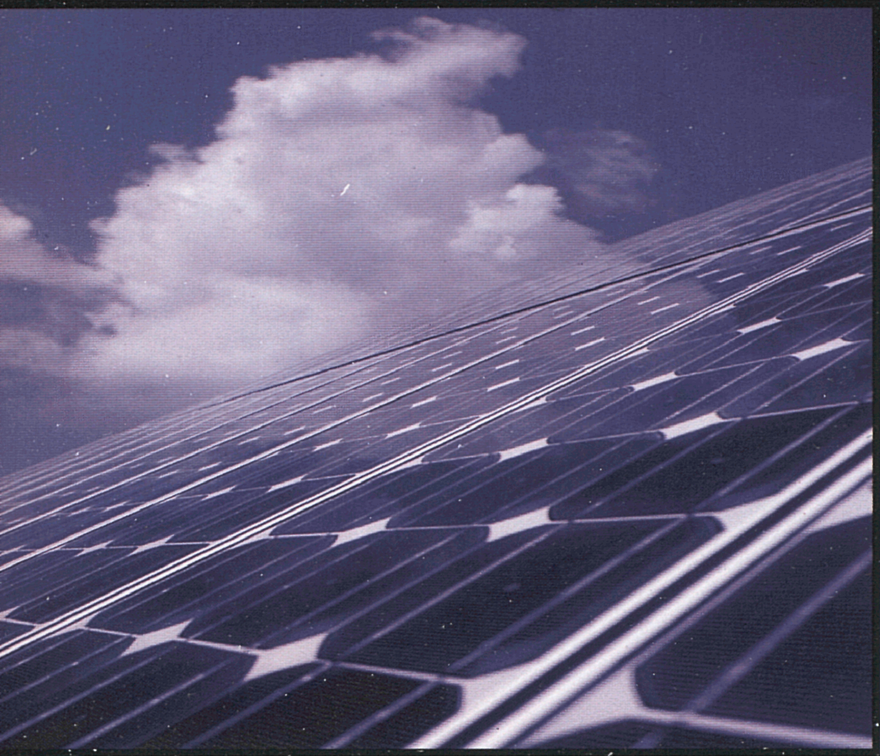
In the energy sector, the concept of "energy services" will become the focus of future initiatives. This concept has been developed as a consequence of our discussions and feedback from the various organisations which benefit from, and contribute to, the support offered by JOULE-THERMIE. In September 1998, a conference was held in Lisbon to discuss this very issue. The messages from this and other events, and from on-going consultations with market actors, have allowed us to concentrate and refine our ideas for future initiatives to support clean and efficient energy technologies.

This concept is driven by one overwhelming objective - the need to bring activities closer to the real needs of market actors and of the local citizen. Future activities must move from focusing on technological improvements per se, to the use of technology to solve the key problems facing society today and meet the needs of the citizen; it means to shift from a RTD system which is mainly "technology push" to one which is much more "market driven". Thus technology should become a tool to help people and improve the quality of their lives through providing energy supply and services. The concept should now be one of "energy service rather than simply technology".

In their realisation within new programmes and initiatives, such as the Fifth Framework Programme, these principles must translate into a prioritisation of activities appropriate to the stage of the particular technology in the chain of development – whether research, development, demonstration, dissemination or market penetration. Analysis already conducted, supported by experts, concludes that over the short to medium-term, demonstration activities are the most cost-effective and environmentally acceptable methods available to help increase market penetration of new technologies, thus meeting the immediate, short and medium/short terms needs of consumer, and to help realise the opportunities offered by the growing European and global markets.

The exact nature of THERMIE and its successors will inevitably change and adapt. The central objective, however, remains the same – how best to realise a process that demonstrates the role of new energy technologies in the development of our industries and our societies of today and tomorrow, and thus foster their market deployment to the benefit of all.





# AN INTRODUCTION

## WHERE ARE WE NOW?

Launched in 1995, JOULE-THERMIE was the European Union's Programme supporting the progression of improved non-nuclear energy technologies from R&D through to demonstration and market penetration. This combined Programme has directly linked the R&D supports of JOULE, managed by Directorate-General XII, with the demonstration, dissemination and market development supports of THERMIE, managed by Directorate-General XVII. The latter is the subject of this report.

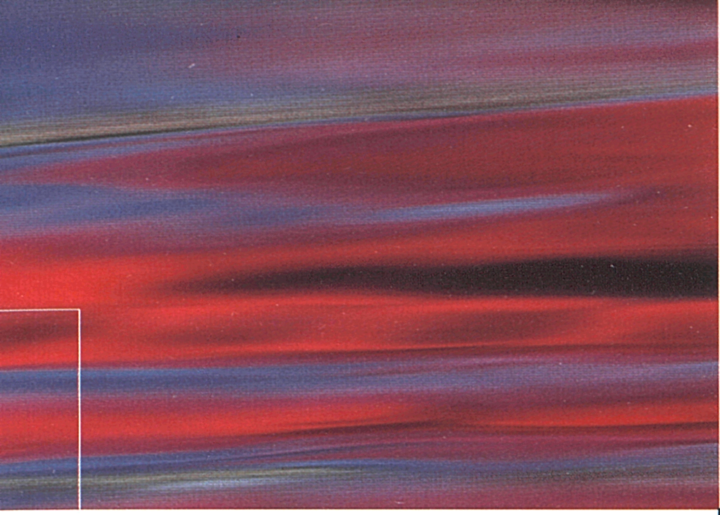
The focus of the THERMIE component is on the demonstration and promotion of clean and efficient energy technologies in three broad areas:

- renewable energy sources;
- rational use of energy in buildings, industry and transport; and
- cleaner and more efficient use of fossil fuels and more effective exploration, distribution and transportation of hydrocarbons.

Taken together, this Activity Report and its two predecessors complement the separate accounts prepared for the JOULE part of the Programme and form a compilation of the activities and achievements of THERMIE over the last four years.

The final launch of new THERMIE projects under the Programme has now been completed. Of course the schedules of these and many other projects extend well beyond 1998, as will their results and impacts.

Nonetheless, in its timing, this report allows us to take stock of a growing set of new achievements, experiences and insights. Many of the projects started during the course of the Programme have now come to fruition. Indeed, in some cases a number of years have passed since the end of the projects themselves. This gives the opportunity to look beyond the performance and benefits at the level of individual projects, to the wider developmental impact that projects can make over time. These impacts therefore receive particular attention in this Activity Report.



## AN EVOLVING PROCESS

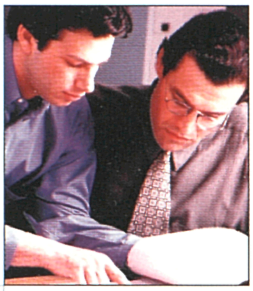
Even over the course of a four year Programme, adaptability has been an important principle in the evolution and management of THERMIE, responding to new demands and opportunities arising from the fast-changing nature of modern technology, industry and society. The process of ordering and adjusting priorities and aims has been developed through on-going consultation with our partners in the Programme – industries, utilities, regional/local authorities, NGOs etc. For example, two major conferences in October 1996 (Brussels, Belgium), and September, 1998 (Lisbon, Portugal) were organised to help define the future European Community agenda for energy technology development and to ensure that it will be at the cutting-edge of RTD.

In 1998, special attention was given to targeted calls for proposals which sought to further encourage industrial organisations to participate in the Programme. Technologies were "clustered" together to maximise the resources that could be made available. One such example was in the field of gas turbines. In addition, to help with the specific dissemination of information about the demonstration projects themselves, the link between the technical and the promotional activities in the Programme was brought closer together. This effort was further enhanced by focusing on networking, through the OPET Network (*see below*), and establishing links to other international bodies, such as the International Energy Agency and EBRD (European Bank of Reconstruction and Development). Finally, in 1998, preparations for the Fifth Framework Programme were launched.

At a more practical level, in 1998 the Programme focused on measures to improve some of the administrative functions of our work. These included efforts to enhance contract negotiations and ensure an accurate administrative follow-up during the preparation of new contracts. Reporting from the projects is now associated with tangible project developments which helps us keep an in-depth understanding of how projects are progressing. Moreover, an integrated programme management system (PMS) is being developed to help project officers monitor their projects.

The second, more practical, area which has been improved during the year is the development of a more aggressive approach to information, communication and dissemination of material. Key activities undertaken throughout the year, alongside this report itself, have included:

- A set of seven sectorial reports covering: international co-operation; the OPET Network, urban technologies, industry, renewables, solid fuels and oil and gas. Each of these documents gives more information on the activities within the sector;
- A programme to reprint technical publications. An analysis of most technical publications produced during 1990-1994 has been made by external experts. Around 15 publications (mainly maxibrochures) have been judged the most suitable for further dissemination on the market, and are in the process of being reprinted;
- A database – THEMIS – has been developed which provides details on all associated measures (Type B activities) carried out from 1995 to 1997. This information was published as a stand alone report, the THEMIS Synopsis;
- The SESAME database containing details of the demonstration projects (Type A) was made available through the DG XVII internet site: (http://europa.eu.int/en/comm/dg17/thproj.htm).



## RESULTS FROM THE PAST

During the four years of the Programme, THERMIE has supported over 500 demonstration projects across the three main sectors of activities. To help the benefits of these projects become more widely known and stimulate replication in various European markets, THERMIE has also contributed towards a further 715 associated measures such as studies, workshops, publications and other promotional material.

THERMIE does not act simply as a source of funding alone. A fundamental concept behind the Programme's activities is that of creating and maintaining a partnering relationship with transnational project consortia. This approach is important in seeking to maximise the success and spin-off benefits of the venture.

For partners themselves, the impacts of projects and associated measures have been significant, for example, helping to improve the competitiveness of an industrial process, helping to introduce a cleaner or renewable new energy technology to market, and helping to achieve better transport systems or better comfort levels in buildings. Directly or indirectly, these benefits all represent an improved quality of life while, at the level of the firm, projects can also facilitate company growth and lead to employment creation.

Moreover, the benefits of projects are cumulatively assisting other Community objectives, in contributing to improving security of energy supply, protecting our environment and in forming international partnerships with countries and citizens outside Europe.

This report, marking the end of the Programme, identifies and highlights a selection of these impacts and past results. In doing this, it draws on various analyses and studies carried out over recent years.

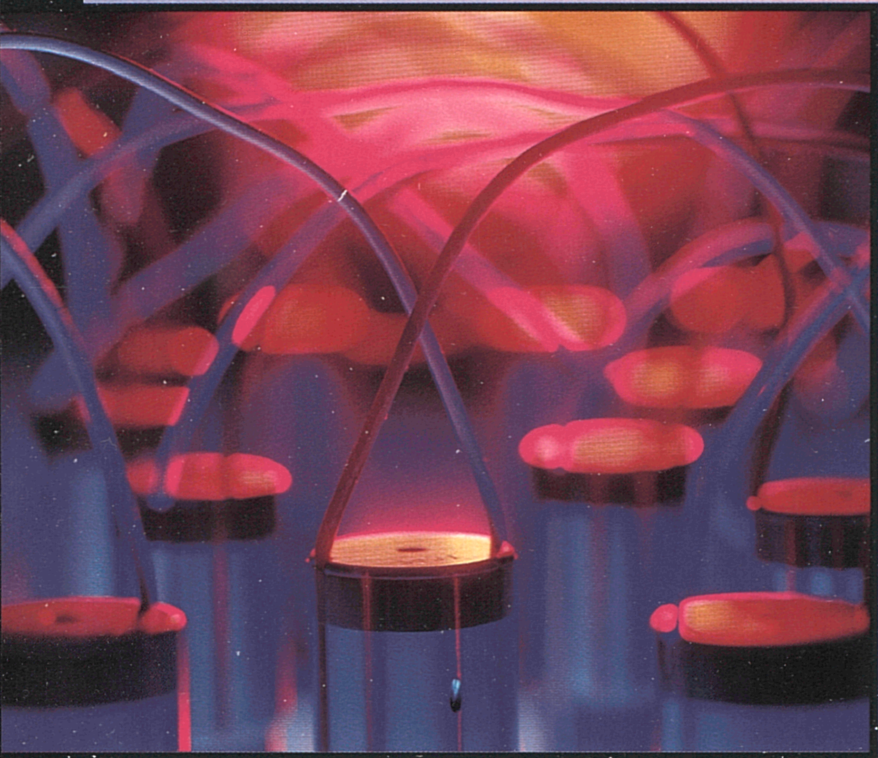
## A VIEW TO THE FUTURE

In the field of RTD policy, the end of 1998 represents a watershed between the European Community's Fourth Framework Programme and its successor. Although a degree of detail still remains to be finalised on the exact nature of the new, Fifth Framework Programme, the broad thrust is clear.

In March 1998, the Council of Ministers formally adopted its common position on the Fifth Framework Programme. The European Parliament adopted its second opinion on the Fifth Framework Programme on June 1998. By October 1998, the European Union Research Ministers reached agreement on the content of three specific programmes and made progress on a further two. This agreement included a consensus on the content of the non-nuclear section of the Energy, Environment and Sustainable Development programme.

To help us understand the exact nature of the new activities, the European Commission is organising a major conference to launch the Fifth Framework Programme during February 1999, in Essen, Germany. The purpose of the conference is to present the new features of the programme, to explain to interested parties how to participate, and to give examples of particularly successful European projects.

The lessons from THERMIE, and the development of a new concept for supporting the demonstration of clean and efficient energy technologies, continue to remain as valid now as they were in the previous few years. This view is one raised time and time again by the recipients of the Programme's support, and the partners in the projects.



# MEASURING SUCCESS

## THE IMPACT OF THERMIE

THE SUCCESS OF AN INITIATIVE SUCH AS THERMIE IS MORE THAN JUST THE VOLUME OF RESOURCES (INPUTS) THAT IT CONTRIBUTES TOWARDS DEMONSTRATION, DISSEMINATION AND PROMOTION. IT IS ALSO MORE THAN THE PHYSICAL NUMBER OF PROJECTS, STUDIES, WORKSHOPS AND PUBLICATIONS (OUTPUTS) THAT ARE REALISED. WHILE IT IS RELATIVELY STRAIGHTFORWARD TO PROVIDE FACTS AND FIGURES ON THE RESOURCES ALLOCATED AND THE NUMBERS OF PROJECTS SUPPORTED (THIS INFORMATION AND DATA ARE SUPPLIED LATER IN THE REPORT), IT IS LESS EASY TO LOOK BEYOND THIS INITIAL INDICATOR OF A PROGRAMME'S ACTIVITIES.

However, despite the complexity of such an issue, it remains vital that we understand the impact that a measure such as THERMIE can have on the immediate participants in a project and on wider society. In order to comment on these impacts, it is necessary to ask the following questions:

- What results have been achieved by the projects?
- What impact has the technological project had on the participants themselves?
- What subsequent impact has the project, and the technology developed, had on the wider state-of-the-art and society itself?
- How do the associated measures fit in to this scheme, and how can their impact be measured?
- How can the activities contribute to the more global political and socio-economic objectives of the EU and its Member States?

It is only by beginning to understand the answers to these questions that it is possible to learn what has actually been achieved, and to help in the definition of future priorities which represent the cutting edge of technological development.

In this section, we highlight these impacts according to three main categories. First, the contributions that the projects themselves, and the Programme's activities, can have on wider political and socio-economic debates. Second, the benefits of the projects at the level of the participants (i.e. the contractors). Finally, the results of the efforts at a scientific and technological level in terms of achievements.

**TABLE 1** **LARGER ENERGY-CONSUMING INDUSTRIES IN THE EU**

| Product/process | Primary energy demand (% of EU total) |
|---|---|
| Building bricks | 0.3 |
| Bulk chemicals | 2.0 |
| Cement | 1.4 |
| Dairy | 0.4 |
| Glass | 0.4 |
| Non-ferrous metals | 1.1 |
| Oil products | 3.1 |
| Paper | 1.7 |
| Petrochemicals/plastics | 5.3 |
| Steel | 5.7 |
| Sugar | 0.4 |
| Textile/leathers | 1.1 |

*Source: Atlas Project, DG XVII*

## THE WIDER DEBATE

At the core of the aims of the European Union as a whole, are three central objectives. First, to help promote economic growth and create employment. Second, to improve the competitiveness of our industries. Third, to protect our environment and contribute towards sustainable development.

Achieving long-term sustainable economic growth and employment creation remains one of the fundamental desires of industries and citizens across Europe. New energy technologies, such as those supported by initiatives such as JOULE-THERMIE, can make an important contribution towards achievement of both these objectives.

A more efficient use of resources, such as fuels and electricity, helps improve the relative cost-effectiveness of our industries and hence the goods and services they make and sell.

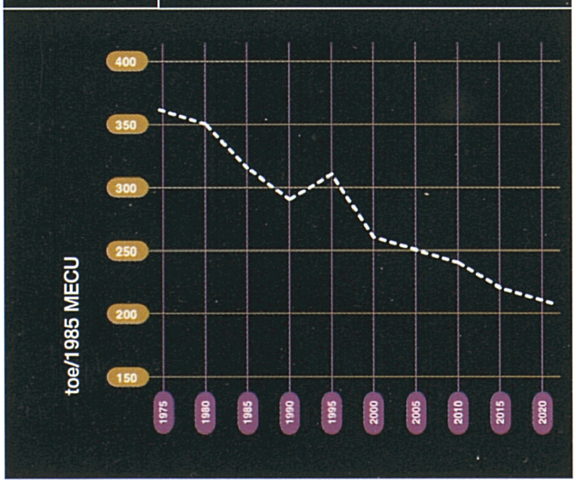
As the recent economic crisis in the Far East has shown, the world is truly a global village. Likewise, our industries across the EU are intrinsically connected to the ebbs and flows of international markets. The pressure to ensure the competitiveness of our industries, relative to key competitors such as the USA and Japan, remains as intense as ever.

Industry still remains the largest user of energy in the EU, accounting for around 35% of EU primary energy demand. Table 1 highlights some of the larger energy-consuming industries.

The technologies supported under programmes like THERMIE have contributed to a more efficient use of resources within these industries, thus reducing costs and making the companies more competitive. The indicator commonly used to measure the "efficiency of energy use" in the industrial sector is that of energy consumption per unit of output, known as "energy intensity".

Since the Commission began its energy technology activities in the early 1970s, the energy intensity in industry has been falling; Figure 1. Over the period from 1975 to 1995, the overall energy intensity decreased by about 1.4% per annum. This trend is set to continue, with expected reductions approaching nearly 2% per annum. Whilst other factors contribute to this reduction, such as a move towards light industry, improvements in energy efficiency have played a major role.

**FIGURE 1** **TOTAL ENERGY INTENSITY IN THE EU**




*Source: European Energy to 2020, DG XVII*

Programmes such as THERMIE and SAVE have contributed to this process. With respect to technological development under the former, much progress has been achieved in increasing the efficiency of the technological stock in our industries.

This is highlighted in more detail in later sections. However, as an example, Figure 2 sets out the kind of achievements being made for the kinds of technological applications supported by these initiatives.

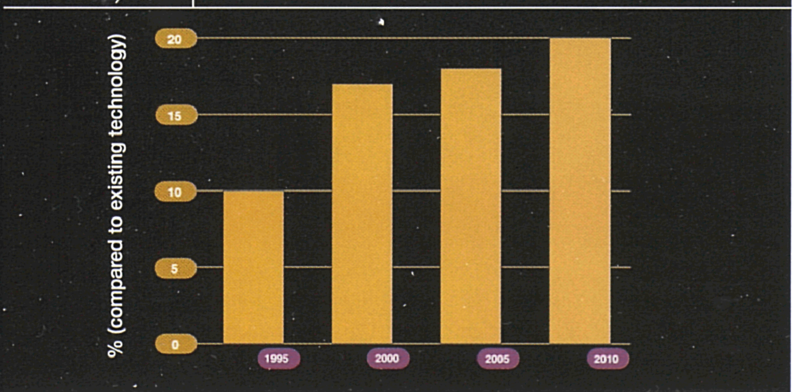
In this example, the production of heat in burners has been improved by incorporating a technology known as a recuperative or regenerative boiler. In general terms, the application of these systems in sectors such as iron and steel, brick manufacture or glass production, can greatly improve the energy efficiency of the process.

The EU has supported demonstration projects in this area and these are achieving these kinds of results, whilst also ensuring that targets for emissions levels (particularly NOx ) are met.
To realise these kind of savings, the investments required need not be excessive. An analysis of the types of technologies supported under THERMIE showed that the energy savings achieved, relative to the investment costs, yielded some attractive payback periods. Table 2 on the right contains this analysis for the sector of process integration in various industrial sectors.

What it shows us, is that investment in new energy technologies, through research and technological development, can have a real impact on the efficiency of energy-use in key sectors such as industry. These energy benefits directly translate into cost savings and, therefore, can help improve the competitiveness of our industries, and thus encourage economic growth.

But our competitors are not standing still in terms of their support for the process of technological development; see Figures 3 and 4. That is why we in the EU must continue to invest in the types of activities carried out within the JOULE-THERMIE Programme, and those of the Member States themselves.

**FIGURE 2** **ENERGY SAVINGS FROM EFFICIENT BURNER TECHNOLOGIES**




*Source: Atlas Project, DG XVII*

### Employment creation

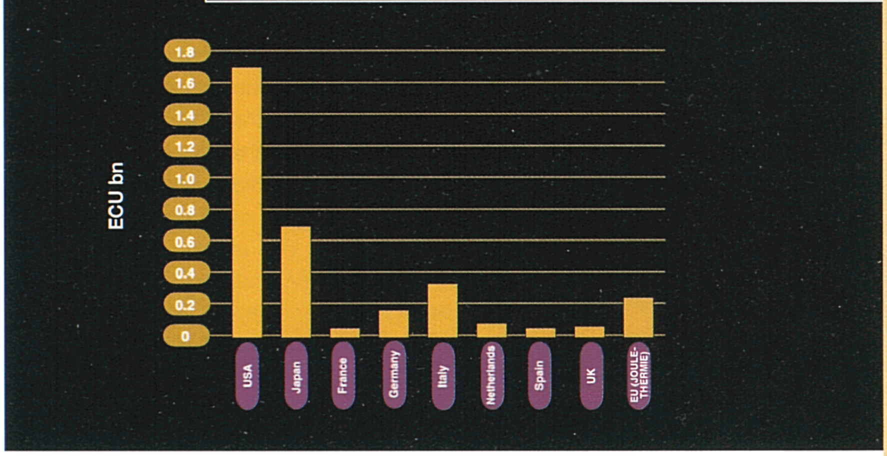
*Investment in new technologies can also have an impact in another area, namely that of employment creation. Many of the technologies supported by initiatives such as THERMIE are more labour intensive than their conventional competitors, either in manufacturing and installation, or in operation and maintenance. Thus, investing in these applications, and the firms that produce them, allows for a contribution towards employment creation. Moreover, many of the jobs created are highly skilled, or are located in priority areas, such as our rural societies.*

## TABLE 2 — POTENTIAL ENERGY SAVINGS AND PAYBACK TIMES FOR PROCESS INTEGRATION TECHNOLOGIES

| Sector | Process/ application | Identified savings (%) | Typical payback period (years) |
|---|---|---|---|
| Oil refining | Crude distillation | 12 | 1 |
| Chemical | Aromatics | 10 | 1 |
| | Tar-based chemicals | 15 | 1 |
| | Sulphur-based chemicals | 42 | 1 |
| Food and drink | Brewery | 21 | 1 |
| | Distillery | 24 | 3 |
| | Beverages | 21 | 2 |

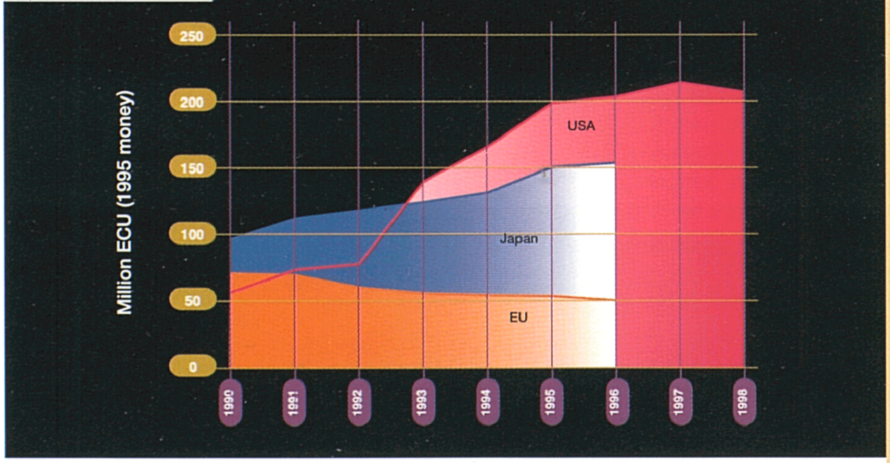
*Source: Atlas Project, DG XVII*

## FIGURE 3 — APPROXIMATE ANNUAL R&D BUDGET FOR ALL ENERGY TECHNOLOGIES (EXCLUDING CONVENTIONAL NUCLEAR, FUSION AND BREEDERS)



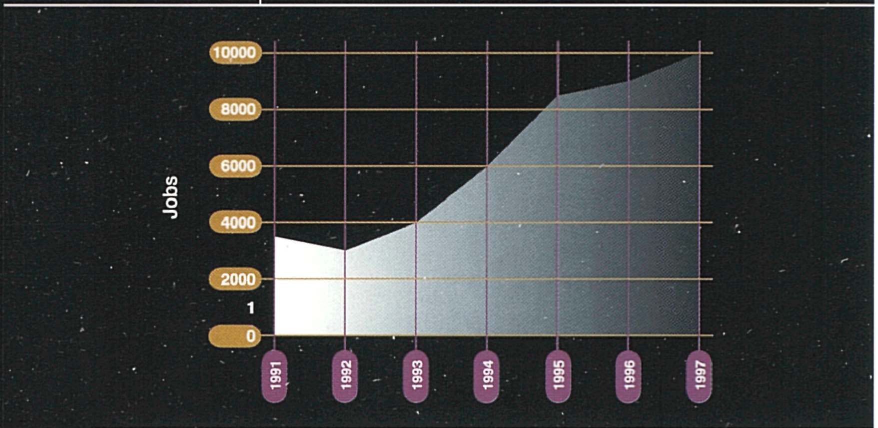

*Source: "Energy Policies of IEA Countries", International Energy Agency (1995)*

## FIGURE 4 — WORLD OIL AND GAS RTD SPEND




*Source: DG XVII*

**FIGURE 5** **DIRECT AND INDIRECT EMPLOYMENT IN WIND ENERGY IN DENMARK**




*Source: Danish Wind Turbine Manufacturers Association*

**Employment creation**

*Quantifying the employment impact of a programme such as THERMIE is difficult without a detailed ex-post evaluation of the projects themselves. Nevertheless, analyses by leading European research groups and trade associations all point to net positive impacts on job creation. Figure 5 is one such example of a study, focusing on wind power in Denmark.*

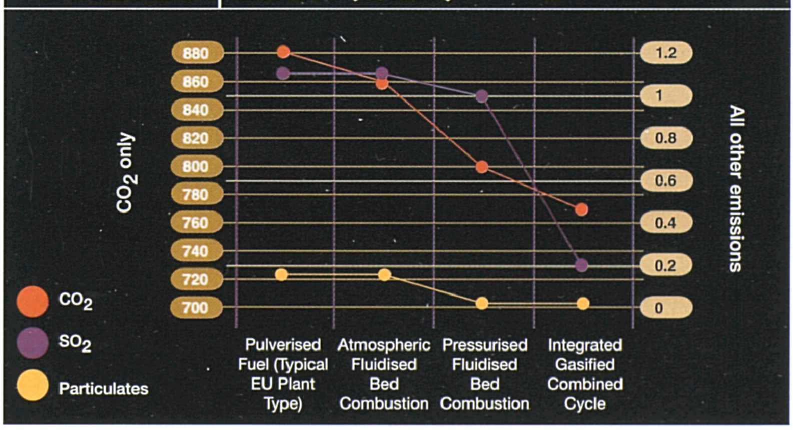
Investing in technology to stimulate economic growth is not sufficient, in itself, to meet our objectives. We must also work towards promoting sustainable development and protection of our environments. A measure such as THERMIE, with its emphasis on clean and efficient technologies, can make a substantial contribution towards achievement of these aims.

All of the technologies and applications supported under THERMIE offer access to zero or low-emissions of gases such as $CO_2$, the main greenhouse gas. The impact of a Programme such as ours can be felt in many sectors – from energy supply to energy use.

In the Solid Fuels sector, for example, the advanced coal technologies supported within THERMIE offer access to substantial reductions in emissions of greenhouse gases and those responsible for acid deposition. A recent analysis by the European Commission sought to quantify these savings (see Figure 6).

As a consequence of the investments made in new technologies, and changing patterns of energy supply, the Member States of the EU, and the EU itself, are contributing to lowering the emissions of greenhouse gases.

**FIGURE 6** **COAL FUEL CYCLE EMISSION FACTORS (G/KWH)**




*Source: Externe Project, DG XII*

## AT THE MICRO-LEVEL

Following on from its contribution to achievement of the wider policy objectives of the EU itself, THERMIE also has beneficial impacts at the micro-level. By its very definition, a THERMIE project, whether demonstration or associated measure, requires the organisation of a transnational consortium with partners from at least two different countries. These partnerships are the recipients of the financial support provided through the Programme.

The investments made from EU funds can help a project partner in many different ways. Firstly, the mechanism allows for the creation of a vehicle to support the exchange of information and experience between companies and organisations across the EU and beyond. This transnational dimension is one of the main benefits of a Europe-wide initiative, as opposed to those in the Member States.

*"Photovoltaics, producing energy from the sun, is a relatively new technology not known to many decision-makers. The (THERMIE) Programme, and the opportunities in the Programme to meet international and European stakeholders, is of prime importance to the future of the industry and to Shell Solar".*

*G. Boxhoorn, General Manager,*
*Shell Solar Energy B.V.,*
*the Netherlands.*

A basic analysis of the demonstration projects supported under THERMIE shows that, on average, three to four different organisations are involved in each project. In many cases, particularly the Oil and Gas sector, the partners are both large multinationals and Small to Medium-sized Enterprises (SMEs). This feature highlights the networking role of the projects and is an encouraging impact.

Second, the "additionality" of the funding provided by the EU allows the resources to be blended with the company's own investments of financial and human resource in the project. As much of the work undertaken under THERMIE is high-risk in nature (in terms of technological and commercial factors), the impact of the European funding is to stimulate projects which would not otherwise have gone ahead, or to the same extent. This impact was one of the main conclusions reported during the recent Lisbon Conference (September 1998), involving contractors from across the Programme's sectors.

*"The EU support and funding through the THERMIE Programme led to a reduction of the investment risks involved in the project and was a determinant for some companies to join. The Commission had a catalytic effect in the constitution of ELCOGAS, undertaken by eight European utilities and three equipment suppliers".*

*M. Treviño,*
*Managing Director and C.E.O.,*
*ELCOGAS S.A., Spain.*

Third, all of the projects supported by THERMIE are of a pre-competitive nature. However, since they are focused on commercial-scale demonstrations of a given technology, they are, by definition, close to the market. One impact of THERMIE is to stimulate and encourage organisations that take part in the project to move towards the commercialisation of the technology in due course, after the initial investments have been made.

*"The ARBRE project is the first large-scale commercial demonstration of electricity production from a high efficiency gasification process, with wood from established forests and new coppices as its sustainable fuel supplies. The sector has a large potential, the technology had completed its research stage and was ready to enter the market place to be fully demonstrated for the first time. The co-operation with the European Commission via a major contract in its THERMIE Programme enabled the technical and financial risks of the project to be shared. This has enabled development of the sector to commence, with resulting benefits to the environment, job creation and rural diversification, in other words, several major successes!".*

*K. Pitcher, Director,*
*ARBRE Energy Limited,*
*United Kingdom.*

This commercialisation can be beneficial in many ways. For example, it can bring increased sales and turnover through replication, or through licences and other forms of commercial contracts with third parties who may take the results forward.

Finally, if you put to one side the commercialisation and exploitation impacts of the Programme, its activities can also make a more altruistic contribution to society as a whole. Many of the organisations that are involved in the Programme, do not do so for commercial reasons. For example, universities, Local/Regional Authorities and NGOs. For these types of organisation, the Programme can have an impact in other ways, such as:

- Providing information of benefit to raising awareness of environmental issues and of strategy development;
- Improving the management capabilities of organisations;
- Improving technical resources and facilities.

*"Attracting finance has always been a real barrier for innovative energy projects. An impressive penetration of RES/RUE energy technologies was finally achieved through Law 9 and Law 10, for CHP and for up to 1 GWe of renewable energy. ENEA has undertaken several THERMIE Type B projects aimed at stimulating the private sector to get involved in the innovative financing of sustainable energy projects. The help of the Programme has be invaluable in forming the basic concept for this theme at the Italian National Energy-Environment Conference (Rome, November 25-28, 1998) and to enrich its conclusions with elements of a new Financial Strategy for Environmental Energy Projects".*

*F. Ciampa,*
*Energy Department,*
*ENEA, Italy.*

## TECHNOLOGICAL ACHIEVEMENTS

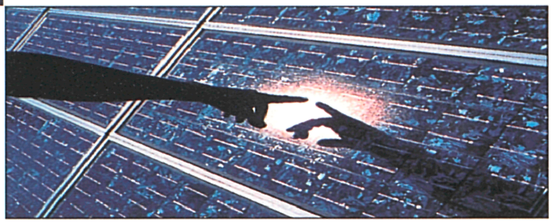
The final set of impacts of THERMIE relate to the scientific and technical achievements, insights and added value arising from the projects. Across the three main sectors of the Programme, the projects undertaken advance the technological state-of-the-art and help drive forward the boundaries of our knowledge into new technological processes and how to achieve take-up.

It is difficult to cover the totality of such technological achievements in a limited report of this kind. However, the following represents a selection of some of the more notable impacts from the different sectors.

### RENEWABLE ENERGY SOURCES

In this sector, the two key objectives of an RTD Programme are to facilitate cost-convergence with existing means of energy supply and to assist improvements in technical standards and the reliability of equipment.

In terms of market penetration, it is first important to recognise that new developments do not often fail to become commercialised because of the problems with the technology itself. Providing the technology actually works, there are far more complex reasons why take-up does not occur as rapidly in practice as it might. Leaving aside issues related to market



barriers such as access to finance, information and attitudes of users and investors, it is often a question of how the new technology compares to existing systems, both in cost and in efficiency of operation, that determines the extent of market penetration.

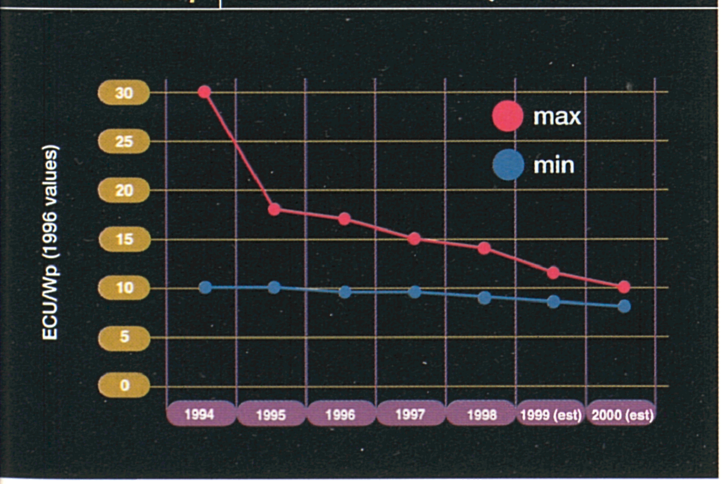
The example of solar photovoltaics (PV), below, highlights how THERMIE, and other programmes in the public and private sector, have been successful in enabling technologies to overcome these obstacles by focusing on cost reduction and efficiency gains.

As recognised by authoritative bodies such as the European Photovoltaic Industry Association, the key objective of any PV demonstration programme must be to reduce PV system costs, in order to bring about price convergence. Whilst PV can be cost-competitive in niche applications, or in rural electricity supply where no other competitor exists, in bulk power supply its relative attractiveness is more remote. This is why THERMIE has focused strongly on cost reduction as a key objective in its demonstration activities. Figure 7 below, shows the success that has been achieved.

More and more technological improvements will come about in the future, all of which will add further to cost reduction. These include simplification of grid connection systems; standardised designs for building integrated PV; AC modules; optimised hybrid systems; and turn-key plant.

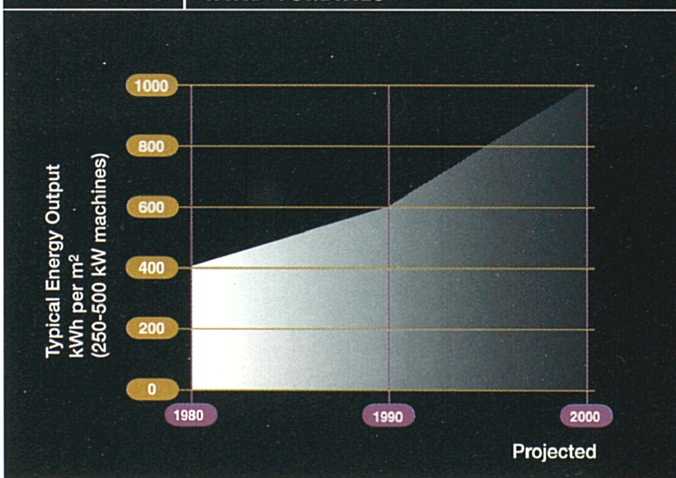
Technical performance is another key area where the Programme's (and other) initiatives have been focused. In this case, the impact of THERMIE has been to improve the reliability and efficiency of the technologies and applications, so as to encourage their market deployment. In the wind sector, THERMIE has been contributing to the continual improvement in energy yields by increasing reliability and encouraging higher technical standards (Figure 8).

**FIGURE 7** **THERMIE PV DEMONSTRATION PROJECT COSTS**




*Source: DG XVII*

**FIGURE 8** **TYPICAL ENERGY OUTPUT FOR WIND TURBINES**

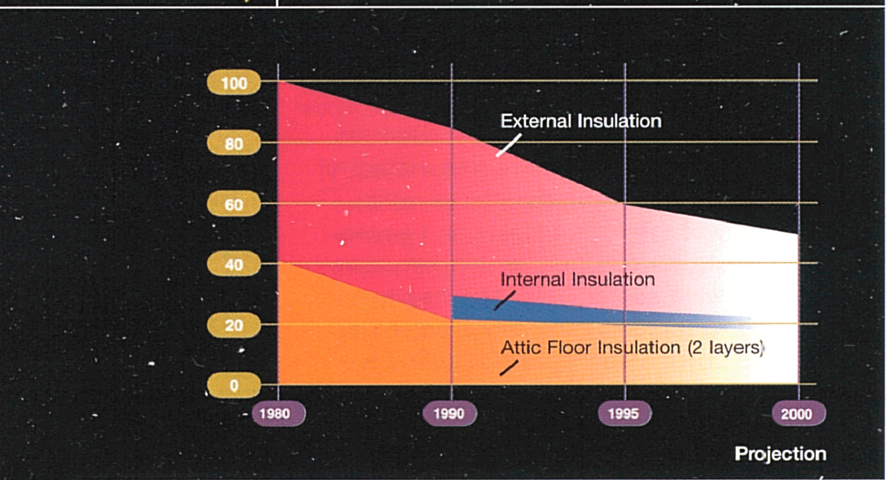



*Source: International Energy Agency*

## *RATIONAL USE OF ENERGY*

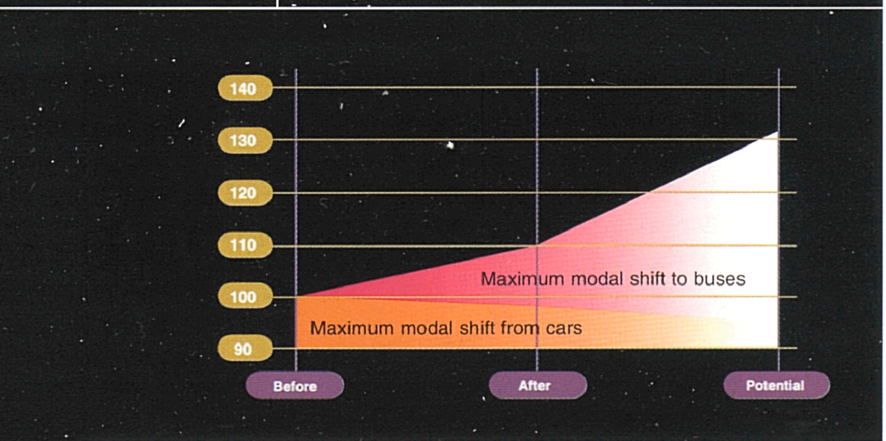
In this sector too, the issue of cost reductions is an important measure of the viability of technological penetration. For example, in the buildings sector, the marginal cost of the new technology supported by THERMIE has been falling, relative to the cost of a building without the energy saving application (see Figure 9). This means that the economic attractiveness of new, clean and efficient energy technologies is increasing. Dissemination of information about these benefits further encourages market penetration.

**FIGURE 9** **BUILDING INSULATION COST REDUCTIONS**




*Source: Atlas Study, DG XVII*

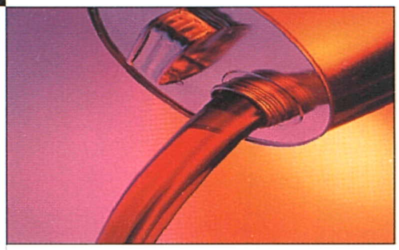
**FIGURE 10** **MODAL SHIFT IN THE JUPITER TTP**




*Source: "Results of Targeted Transport Projects", DG XVII*

In the transport sector, one of the key objectives of the Programme is to convince the citizens of towns and cities to move away from the private car towards public transport, a concept known as "modal shift". In one of the Transport Targeted Projects (TTP) – JUPITER – measurements were made of the direct impact of the project on this objective (Figure 10). As you can see, from a base line of 100, modal shifts towards greater public transport and less private car usage were achieved following completion of the project, and there is potential for even greater movements when projects are replicated across a wider area of the city in question.

In the energy industry sector the Commission follows the growing concern connected with the fragile competitiveness of the European gas turbine industry expressed last year at the time of the creation of the industrial groupings of European manufacturers of gas turbines (EuMIGT and EROP) promoted by the Commission. In 1998 a targeted call was launched for demonstration projects on super efficient advanced gas turbine systems. The objective of the demonstration activities covered by this targeted call for proposals is to encourage the development of innovative technologies improving the efficiency of small to medium gas turbines sizes and related systems fuelled with natural gas to be implemented in real industrial stationary applications (power generation, cogeneration, mechanical drive or any other industrial application including offshore exploitation). The call applies to new installations as well as upgraded or retrofitted installations. The planned demonstration project(s) will be able to demonstrate the technical feasability and their economic advantages to achieve continuously a substantial increase in efficiency and reliable operation and high availability compared to the performances of today's gas turbine systems accompanied by low emmission levels.



## FOSSIL FUELS

### Solid fuels

In this field, technical improvements in terms of thermal efficiency play a vital role in fostering market penetration of new systems. In the solid fuel sector, THERMIE has, for many years, supported research into these so called "clean coal technologies". This is due to a recognition of the continuing importance of this fuel, especially in developing countries, but coupled with the need to improve the environmental and thermal performance of the combustion process.

Most large-scale conventional power plants have net thermal efficiencies in the order of 38% for hard coal and 35% for brown coal. New systems are being developed which are aimed at increasing this, over the medium-term, to at least 50%. This will result in a reduction of 0.21 kg of $CO_2$ per kWh generated for hard coal, and 0.34 kg/kWh generated for brown coal. In the EU countries alone, this equates to a $CO_2$ reduction of 180 million tonnes per year; in line with targets set in the context of the climate change debate. This increased efficiency leads to lower fuel costs per unit of output, thought to equate to a reduction of some 2.5 ECU/MWh in generating costs. For a 1 GWe plant operating for 7,000 hours a year, this means a theoretical annual cost cutting potential of about ECU 18 million for consumers.

### Oil and gas

The key priorities in this sector are to improve the efficieny of exploration and production of hydrocarbons and to reduce the environmental impact of the same. THERMIE plays a big role in this by funding the demonstration of new innovative technology in the upstream sector of oil and gas. Some of the most important new technologies that have contributed to the objectives are related to: new drilling and completion techniques, new seismic methods such as multi-component and multi dimension seismic, offshore production structures and facilities, new techniques for deep water storage; and new technology for natural gas exploration and production. Demonstration and market deployment of such technology will allow not only a better exploitation of European indigenous resources but also an increased competitiveness of European service and supply companies.

**TABLE 3** EC SUPPORT IN 1998 – BREAKDOWN BETWEEN DEMONSTRATION (TYPE A) AND ASSOCIATED MEASURES (TYPE B)

| Type of Project | Nº of Projects | EC Support (million ECU) |
|---|---|---|
| Demonstration (Type A) | 129 | 104 |
| Associated Measures (Type B) | 120 | 14 |
| Total | 249 | 118 |

# OVERVIEW OF THERMIE'S ACTIVITIES IN 1998

**SEEING IS BELIEVING**

Activities within THERMIE focus on four areas:

- supporting technological demonstration projects ("Type A", cost-shared actions);
- working on associated measures ("Type B" actions) that help bring the knowledge and information from these efforts to a wider audience (through seminars, workshops, business missions, publications and training actions);
- contributing to the development of transnational networks which help promote the benefits of clean and efficient energy technologies;
- co-ordination with related European Union and programmes in Member States.

The sample of projects in subsequent sections of this report reflects this balanced mix of activities.

## THE IMPORTANCE OF DEMONSTRATION

Energy systems suppliers and consumers are often perceived to be slow to change and sceptical of alternative ideas. As a result, the market penetration of new energy technologies can be a slow and difficult process. Even where the applications reach an advanced state of technological development and offer significant relative advantages over existing systems, their eventual take-up by the market is not always assured.

One obstacle to this process is an expectation that the new systems will be inherently more risky, less reliable or more costly than the previous means of supplying and using energy, and the services that this entails. This is why it remains vital that individuals and companies are made aware of the actual performance of the new systems under real operating conditions. It is often only by demonstrating, at a commercial-scale, the benefits of these systems, that potential users can begin to understand and be convinced of their full scope and benefit.

| TABLE 4 | EC SUPPORT IN 1998 – BREAKDOWN FOR DEMONSTRATION PROJECTS (TYPE A) BY SECTOR | | |
|---|---|---|---|
| | RES | RUE | FF |
| Nº of Projects | 48 | 44 | 37 |
| EC Support (million ECU) | 29 | 31 | 44 |

| TABLE 5 | EC SUPPORT IN 1998 – BREAKDOWN FOR ASSOCIATED MEASURES (TYPE B) | | |
|---|---|---|---|
| | STR | DIS | SME |
| Nº of Projects | 33 | 63 | 24 |
| EC Support (million ECU) | 4 | 7 | 3 |

*RES: Renewable energy sources; RUE: Rational use of energy; FF: Fossil fuels*

## ACCELERATING THE PROCESS

### THE NEED FOR DISSEMINATION AND PROMOTION

In a time of scarce resources, it can never be possible to ensure that all industries and communities in the EU and beyond have ready access to an example of the new technologies in their locality. This is why THERMIE has been active in supporting the wider dissemination of information about the benefits of demonstration projects. It does this through the use of associated measures and through contributions to networking initiatives.

The Programme also works with similar initiatives at the international level, and in the Member States, to try to maximise the synergies of increased co-operation.

## THE YEAR IN DETAIL

### ALLOCATION OF RESOURCES

In 1998, the Programme invested a further ECU 118 million for both new demonstration projects and associated measures. This brings the total support over the course of the Programme to some ECU 566 million since 1995. The allocation of these resources and categorisation of supported projects are given in the Tables 3, 4 and 5.

### VOLUME AND EVOLUTION OF PROPOSALS

In 1998, at a sectoral level, Figures 11, 12 and 13 further disaggregate the results of the 1998 evaluation for different sectors of the Programme.

FIGURE 11 RATIONAL USE OF ENERGY, DEMONSTRATION PROJECTS, 1998

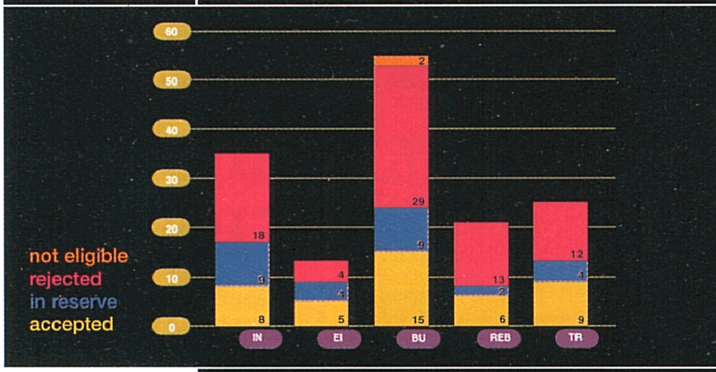



FIGURE 12 RENEWABLE ENERGY SOURCES, DEMONSTRATION PROJECTS, 1998

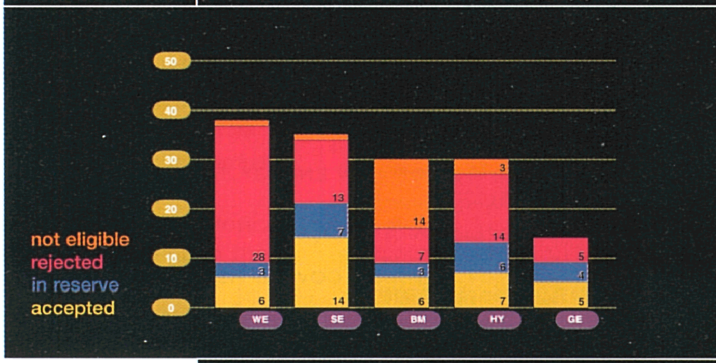
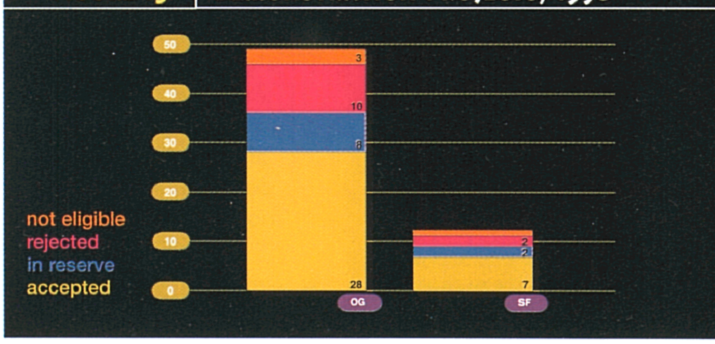
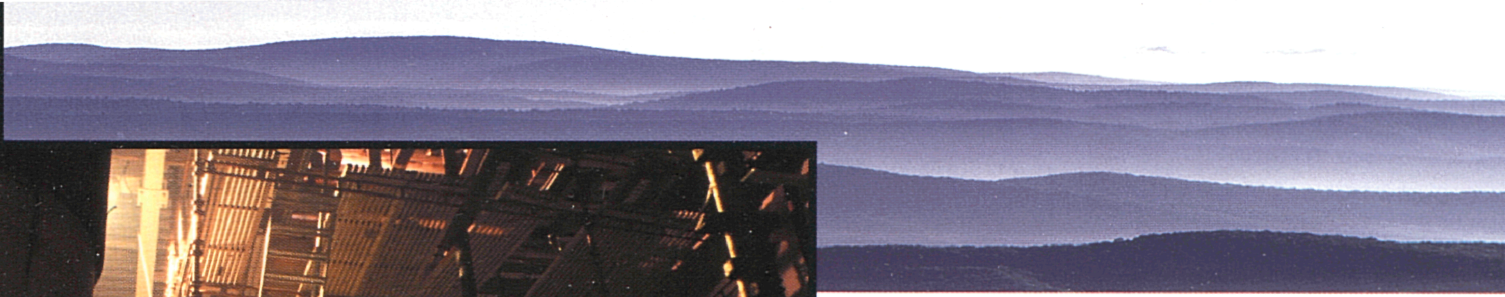
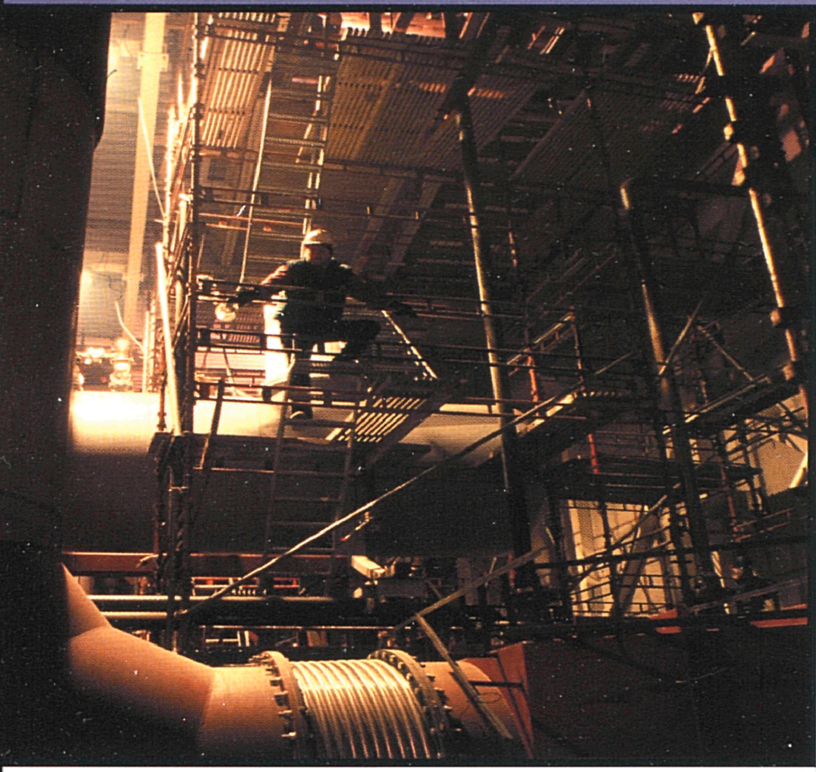



FIGURE 13 FOSSIL FUELS, DEMONSTRATION PROJECTS, 1998

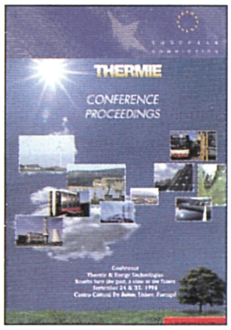



*IN: Industry; EI: Energy Industry; BU: Buildings; REB: Renewable energy in buildings; WE: Wind energy; SE: Solar energy; BM: Biomass; HY: (Small) hydro; GE: Geothermal; OG: Oil and gas; SF: Solid fuels.*





# SUPPORTING ENERGY TECHNOLOGIES


## A CONTINUOUS PROCESS

As already stated, since 1995 THERMIE has committed over ECU 500 million towards the demonstration and market penetration of new energy technologies.

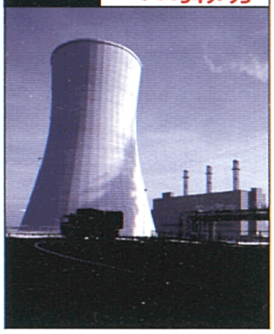
Its integration with the JOULE component, which covers research and development, means the Programme as a whole can support new applications through all the stages in the cycle of technological development.

The sections below highlight, in more detail, where activities have been focused in the last of the four years of the current Programme.
In particular, examples of projects – both demonstration and associated measures – have been chosen to represent some of the impacts that the projects themselves have achieved.

Two distinct types of projects have been selected, those started in earlier years, and whose main results and impacts of which have come to fruition during 1998, and those which were selected for funding and/or launched in 1998. This sample exemplifies what the Programme has been achieving and also gives some indication of the focus of activities which will continue into the future.

## RENEWABLE ENERGY SOURCES

DEMONSTRATION PROJECT
BM/00349/93



### COMBINATION OF A WASTE INCINERATION PLANT WITH A COMBINED CYCLE POWER PLANT

One of the main objectives of THERMIE is to continue to push at the boundaries of the thermal efficiency of electricity supply. Even the smallest increases can result in substantial savings of both resources and pollution, as well as financial benefits.

This innovative project linked a waste incineration furnace with a combined cycle power plant. The project was started in 1993 and commissioned in 1996. Monitoring and evaluation began in 1997. Three incinerator units were built, requiring some 80 t/h waste, with an average energy content of 10.45 MJ/kg. The gross capacity of the integrated operation – the incinerator and the combined cycle unit – is some 73 MWe.

Recent analysis of the plant's performance indicates a 7% increase in the net efficiency of the integrated plant compared to a conventional stand-alone waste incinerator. Nearly 70 GWh/y of extra electricity is generated as a result of this system, with a payback relative to the investment costs and extra operating/maintenance charges, of only three years.

| | |
|---|---|
| **Participating country:** | **The Netherlands** |
| **Total costs:** | **ECU 4.8 million** |
| **THERMIE support:** | **ECU 1.7 million** |

DEMONSTRATION PROJECT
BM/00057/96

### DEMONSTRATION OF THE COMMERCIALISATION POTENTIAL OF THE VALAR 2.5 MW OFFSHORE WIND TURBINE

Wind turbines are now a relatively common sight across Europe, with countries such as Denmark, The Netherlands, Germany, UK, Spain and latterly France, all investing in wind farms. Offshore wind development, although far less advanced, is the greatest prize in this field. The higher mean annual wind speeds and the minimisation of visual amenity impacts, are just two of the advantages that offshore wind power can offer.

However, relative costs of offshore compared to onshore are higher. This project aimed to demonstrate the economic as well as technical viability of offshore wind energy. The former was achieved through the innovative use of a floating jack-up barge which reduced the time and costs of installation. The latter was achieved mainly through the incorporation of new electronic control systems which improved the compatibility with the grid network, and reduced the need for expensive grid strengthening measures.

Five turbines were installed, about 4 km off the coast of Gotland. Each turbine is rated at 500 kW. The average annual output is some 8 GWh/y, from mean wind speeds of 8 m/s. Rock-socketed steel monopile foundations, to water depths of 5 to 6.5 m were used to secure the turbines. Total construction time was only 35 days. Monitoring of impacts on local flora and fauna, such as the seal population, is also being carried out.

| | |
|---|---|
| **Participating countries:** | **Sweden, Denmark, United Kingdom** |
| **Total costs:** | **ECU 3.3 million** |
| **THERMIE support:** | **ECU 1.1 million** |

ASSOCIATED MEASURE
STR-1284-97-GB

### DEVELOPMENT AND IMPLEMENTATION OF A BIO-ENERGY INVESTMENT FUND

Problems in attracting suitable financing has long been recognised as one of the major barriers facing the development of bio-energy (and other renewable) projects. An initial study into the feasibility of such innovative schemes was launched by THERMIE in 1995/96. This concluded that there was a role for such financing routes. This second project developed the concept of a bio-energy investment fund further, studying the detail of such a scheme and producing a prospectus to launch the fund. A fully-funded bio-energy fund, of perhaps ECU 20 to 60 million is envisaged, offering a major boost to pending biomass projects throughout Europe.

**THERMIE support:**
**ECU 175,000**

ASSOCIATED MEASURE
SUP-0995-96

### UNIVERSAL STANDARD FOR SOLAR HOUSE SYSTEMS

Technical standards for solar systems in houses across the EU are far from being well established or consistent. This diversity of standards causes a general problem for Europe's solar industry, which is geared towards exports, as it creates confusion amongst the clients and external countries over which quality system is the best. This project studied existing technical standards, and compared the relative advantages of each. From this analysis, a common standard for a universal application was proposed. Copies of the proposal were disseminated across the EU solar industry to encourage them to adopt this standard, and to help them with the general process of market penetration, particularly within the context of rural electrification in developing countries.

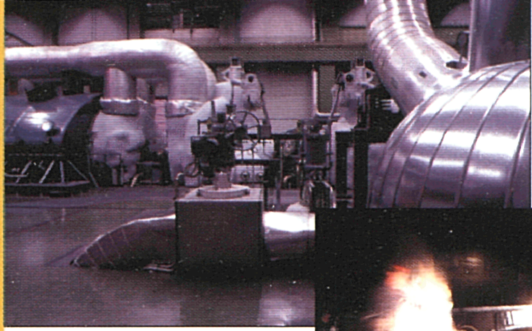
**THERMIE support:**
**ECU 90,000**

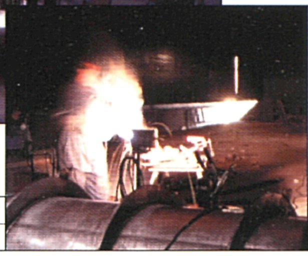
ASSOCIATED MEASURE
SME-1509-97-AT

## STUDY ON THE TECHNICAL AND ECONOMIC FEASIBILITY OF A LOW PRESSURE JET TURBINE

Small-scale hydroelectric schemes are one of several types of Renewable Energy Sources (RES) supported by THERMIE. This supporting action produced a study of the technical and economic feasibility of producing a new type of impulse hydraulic turbine for use in such plants, and is a good example of how associated measures support and complement demonstration projects. Prototypes were produced and tested on a new bench and efficiency diagrams calculated. Production costs were calculated and a market analysis was carried out. The new design of turbine will improve the effectiveness of small-scale hydroelectric plants and this study has already resulted in a proposal, for a full-scale demonstration project, being accepted for support by the THERMIE Programme.

**THERMIE support:**
**ECU 45,000**





DEMONSTRATION PROJECT
BM/00015/96

## CO-UTILISATION OF GASIFIED BIOMASS, REFUSE AND COAL IN A CHP PLANT

Despite moves towards greater use of renewable sources to generate power, much of our electricity is still produced from fossil fuel sources, especially coal. One way to reduce emissions of $SO_2$ and $CO_2$ is to substitute some of the coal used by conventional power stations with alternative fuels which produce lesser amounts of gaseous pollutants. This can be technically difficult, but the benefits of success are considerable in terms of a cleaner environment and long-term cost-savings for the consumer.

This project supported the modification of an existing coal-fired plant in Finland to allow 30% of the coal used to be substituted with biomass and refuse-derived fuels. Because burning biomass in a conventional power station is difficult and expensive, this has been achieved by installing a gasification unit. The gas produced by the gasifier has a very low heat value, especially if the fuel is wet. If, however, this lean gas is mixed with richer gas, produced from coal in the conventional part of the power station, the mixture can be co-combusted, and the need for an expensive fuel dryer is therefore removed. The CFB gasifier at the plant (30 to 70 MW capacity), is complemented by an innovative feed system, which makes it possible to adjust the moisture content of the gas mixture, to ensure optimum combustion conditions in the plant's boiler.

The modified plant has been running since January this year and a testing and monitoring programme has yielded very promising results. The impacts of the innovative technology are already apparent in a decrease in emissions of $CO_2$, NOx, SOx and particulates. Implementation of similar projects could have a significant impact in the fight against global warming and in making our environment healthier.

| | |
|---|---|
| **Participating countries:** | **Finland, Sweden, Denmark** |
| **Total costs:** | **ECU 11.5 million** |
| **THERMIE support:** | **ECU 2.2 million** |

DEMONSTRATION PROJECT
GE/00074/96

## MULTIPLE USE OF LOW TEMPERATURE GEOTHERMAL WATER IN ERDING

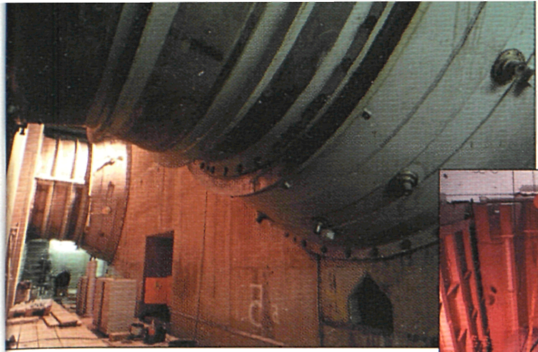
Reclamation and re-use of a former gas exploration borehole will provide geothermal water for a district heating system and drinking water for the town of Erding. As well as providing these direct benefits to the town, implementation of the scheme will result in a reduction in the consumption of fossil fuels to generate energy, with a subsequent positive impact on the environment, and reduced pressure on existing supplies of drinking water.

About 552,000 cubic metres of geothermal water will be extracted from the borehole each year and cooled, using a heat exchanger and heat pump, from a temperature of about 65°C to between 17 and 23°C. The absorption-type heat pump is designed for two-step operation, to give a high heating efficiency (1.7:1, rising to 2.2:1 at peak times). The new district heating network, with a capacity of 17 MW, will supply water, at a temperature of about 40°C, to residential areas, hospitals and schools.

Compared to the conventional system of energy supply currently in use in Erding, the energy produced by this new scheme will replace the equivalent of 29,000 MWh per year of energy generated from fossil fuels (about 51% of energy use).

Once the district heating scheme is established, the geothermal water extracted will be purified and treated (by de-gassing, filtration and ozonation) for use as drinking water, which will be blended with the existing water supply.

| | |
|---|---|
| **Participating countries:** | **Germany, France** |
| **Total costs:** | **ECU 0.8 million** |
| **THERMIE support:** | **ECU 0.3 million** |



DEMONSTRATION PROJECT

HY/00314/91

## TOTALLY SUBMERGED RUN-OF-RIVER HYDRO SCHEME ON THE RIVER NECKAR AT KARLSTOR/HEIDELBERG

This innovative project has demonstrated that, even in the heart of historic Heidelberg, clean energy technologies can be used with no negative impact on the visual and acoustic amenity. A new, totally submerged, run-of-river hydro scheme has been installed that will generate electricity to be fed to the local distribution network. Special design features mean that the flow conditions of the river will remain unaffected, there is a minimal effect on commercial traffic on the river and the attractiveness of the historic city centre is not compromised.

The new hydro scheme was built into an existing weir in such a way that the power house occupies a completely submerged cavern. It is especially important that the hydro scheme does not affect the flooding characteristics of the river, as flooding has become more frequent over the last few decades.

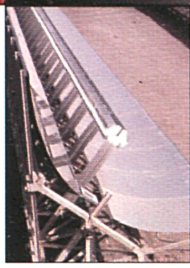
Three bulb-type turbines, with a net head of 2.6 metres and a total flowrate of 140 cubic metres per second, provide an installed capacity of 3.1 MW. The design incorporates a number of innovative features and special components have had to be designed to suit a totally flooded operating environment.

City centres, and especially historic ones, are not generally considered as obvious candidates for the installation of power stations producing renewable energy. This project has demonstrated that such locations can participate in efforts to increase the use of clean and efficient energy technologies.

| | |
|---|---|
| **Participating countries:** | **Germany, France** |
| **Total costs:** | **ECU 3.5 million** |
| **THERMIE support:** | **ECU 1.4 million** |

DEMONSTRATION PROJECT

SE/00064/96



## DEMONSTRATION POWER PLANT BASED ON THE EUCLIDES PHOTOVOLTAIC CONCENTRATOR

This project has supported the construction of a PV power plant, which is the first of its type in the world. The project has built on work carried out under the JOULE Programme and a previous project under the THERMIE Programme. All of the components of the plant were developed during these previous projects and now, in this latest project, the size of the concentrators has been increased to full commercial dimensions. These new, modular, units consist of two 75 metres long rows of PV cells. The new units use reflecting instead of refracting technology, have single-axis tracking and encapsulated modules.

The new plant, named EUCLIDES, has eight units, each with two rows of concentrators 72 metres long and 2.9 metres wide. The two rows in each unit share a single tracking carriage. Each unit is rated at 62 kWp, giving a total rating of 480 kWp. Each tracker has an output of 750 V. In the concentrator units themselves, the cells are interconnected and encapsulated, just like flat modules, and the concentration optics are mirrors instead of the Fresnel lenses used in all previous PV units. The new design provides a more constant output than that from flat panels, and this means that a better price should be obtained for the electricity produced. The PV cells were developed by BP and the tracking system by IES.

| | |
|---|---|
| **Participating countries:** | **Spain, United Kingdom** |
| **Total costs:** | **ECU 3.3 million** |
| **THERMIE support:** | **ECU 1.3 million** |

ASSOCIATED MEASURE

DIS-1579-97-FR

## PUBLISHING A WOOD FUEL NEWSLETTER

A Type B action started in 1995 produced two issues of a newsletter about wood fuel. This project aimed to follow up that success by distributing the newsletter to more than 5,500 recipients and publishing it in English, French and German. There are many types of participant in the field of wood fuel development. With such a variety of actors, it is vital that information about common interests and common difficulties is shared as widely as possible, and a newsletter is an effective way to do that. Dissemination of information will help to create better conditions for the development of innovative wood fuel technologies.

The newsletters contain an editorial, a leading article, several short articles, small news items on recent technological developments, regulations and financial news, and an interview. Three issues will be produced, one every six months, distributed along three main channels: the mailing network of the five partners in the project, to operators appearing in a catalogue entitled, "Wood fuel for heating systems" and at specific events about wood fuel and dissemination networks associated with wood fuel development programmes such as the OPET Network and AFB-Nett.

**THERMIE support:**
**ECU 73,000**

ASSOCIATED MEASURE
STR-1956-98-FR

## ENERGY EFFICIENT TECHNOLOGIES FROM DEMOLITION, PACKAGING AND INDUSTRIAL WOOD WASTE

The aim of this study is to improve the conditions for the dissemination of information about energy-efficient technologies which use demolition, packaging and industrial wood waste to produce energy. The resulting information, on the technical, economic and environmental characteristics of the wood waste, will be aimed, in particular, at key decision-makers, allowing them to choose the most appropriate of the available technologies. In addition, the project will encourage increased exchange of information about energy conversion technologies for wood waste between construction companies, SMEs, wood-processing industries, energy companies and local authorities.

Firstly, an analysis of technical and non-technical barriers to the dissemination of efficient energy technologies will be made. This phase will be focused on conditions in France, Germany and Italy in particular, the countries with the most promising potential for a market in wood waste for energy generation. In the second phase, the results will be used to apply a decision-making methodology in the French region of Alpes-Maritime.

**THERMIE support:**
**ECU 128,000**

DEMONSTRATION PROJECT
HY/227/98

## DEMONSTRATION OF THE USE OF THE NOVEL "STENZEL RADIAL-IMPULSE TURBINE" IN TWO MINI HYDRO PLANTS

The aim of this project is to demonstrate the use of a new type of water turbine, in two small-scale hydro schemes. By showing successful application of the new, more efficient, turbines in two different settings, wider use of the new technology will be encouraged. Free access to the pilot installations will be given, so that potential developers of similar plants can make first-hand assessments of the effectiveness of the new technology.

The Stenzel radial free-jet turbine is a constant pressure water turbine with drive jets formed by two concentric jet rings, each with 16 jet slits around the circumference. A pressure cylinder in the turbine gives automatic adjustment of the jet ring configuration, via two pressure hose connections and solenoids, according to the flowrate. The Stenzel turbine combines the advantages of traditional free jet turbines (high efficiencies during partial loading) with the greater input capacities, at higher nominal rotation speeds, associated with traditional reaction turbines (like Francis turbine). The new turbine should demonstrate lower production costs, compared to existing turbine technologies, while achieving similar outputs.

A major advantage of the new turbine is that it can easily be installed in existing drinking water distribution systems. A common problem in water supply systems located in mountainous regions is the large hydraulic pressure differences, usually addressed by the installation of a pressure dissipation valve. In this pilot project, installation of a Stenzel turbine in the water supply system of the town of Freiding, in Bavaria, will allow conversion of this potential energy into electricity, without affecting the security of the water supply.

| | |
|---|---|
| **Participating countries:** | **Austria, Germany** |
| **Total costs:** | **ECU 283,000** |
| **THERMIE support:** | **ECU 113,000** |

DEMONSTRATION PROJECT
BM/00120/98

## DEMONSTRATION OF A BIOMASS CHP PLANT USING THE ORC-PROCESS

Throughout the last four years of the Programme, THERMIE has concentrated, within the biomass sector, on improving the efficiency of the systems and in minimising any emissions of harmful pollutants such as NOx. This project will demonstrate, for the first time, the incorporation of the ORC-process in a biomass CHP (combined heat and power) plant. The process is normally associated with the geothermal industry, so this project will provide valuable information about the merits of using it in a new application.

The process will allow for a higher electrical efficiency and better partial load behaviour. Furthermore, operating costs are much lower than those of a conventional system, since no steam boiler guard is necessary. NOx reductions in the order of about 30% are considered achievable. Moreover, with the addition of a rotation particle separator, dust concentrations in the flue gas (a potential cause of respiratory diseases) can be kept below 50 mg/Nm$^3$, at costs not dissimilar to that of conventional forms of dust precipitation removal.

| | |
|---|---|
| **Participating countries:** | **Austria, Italy** |
| **Total costs:** | **ECU 1.4 million** |
| **THERMIE support:** | **ECU 0.6 million** |

DEMONSTRATION PROJECT
SE/134/98

## GREEN ELECTRICITY FROM A 180 KWP CENTRAL PV SYSTEM IN THE NETHERLANDS

There is growing interest in green electricity (generated from renewable sources) among consumers. In The Netherlands, increasing demand from consumers for PV systems to supply electricity at their own premises offers an opportunity to market centralised PV systems, which have, until recently, gained little support. More development work needs to be done to improve the appropriate technology for grid-connected PV systems and this project will bring together Italian electricity company ENEL, with their expertise in the operation of centralised PV systems and the marketing expertise of Dutch energy company, EDON. The technology will be demonstrated to the general public and commercial end-users.

The new system, the first ground-based central PV system in The Netherlands, will be installed on top of a concrete storage tank for drinking water, and will consist of three units, each with a capacity of 60 kWp, giving a total capacity of 180 kWp.

The project aims to demonstrate the role that sales of green electricity can play in driving the development of PV, and other renewables, projects. The work will be carried out in close co-operation with key players in the development of PV technology, for example, utility companies, local authorities and industry.

| | |
|---|---|
| **Participating countries:** | **The Netherlands, Italy** |
| **Total costs:** | **ECU 1.5 million** |
| **THERMIE support:** | **ECU 0.5 million** |

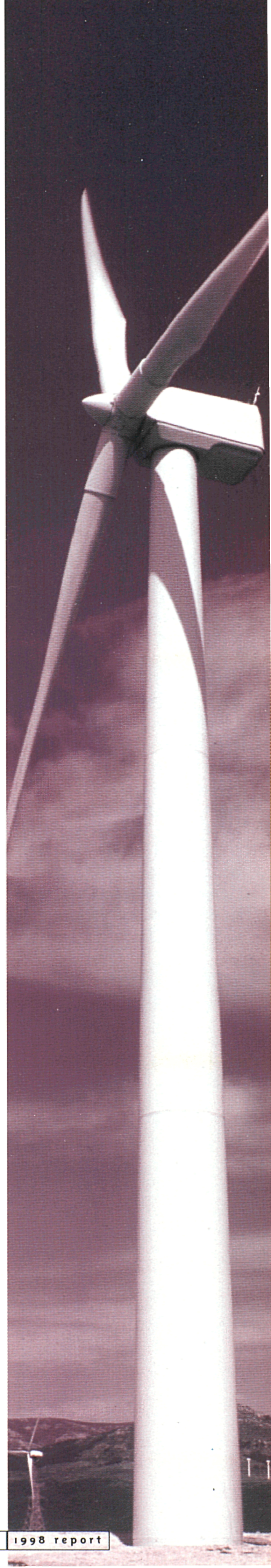
DEMONSTRATION PROJECT
WE/00296/98

## DEMONSTRATION OF TWO HIGH-PERFORMANCE 1 MW WIND TURBINES IN LOW SPEED AREAS

Wind energy developments have, in the past, been concentrated in areas of the world which offer higher than average wind speeds. Often, this means that developments take place in remote and/or sensitive areas. A technology which can increase the economic attractiveness of utilising sites with lower wind speeds would be invaluable.

This project will design, manufacture, install, test and measure the impact of two 1 MW NEG-MICON turbines which have been specially adapted for use in low wind speed areas. The aim is to increase power production by up to 22%, compared to a standard turbine, mainly through the technological adaptations which allow for an enhanced rotor diameter, with a swept area of 2,830 $m^2$, and an increase in tower height from 50 to 70 m. The new turbine will be installed at a site in Central Sweden.

| | |
|---|---|
| **Participating countries:** | **Sweden, Denmark** |
| **Total costs:** | **ECU 2.4 million** |
| **THERMIE support:** | **ECU 0.8 million** |



ASSOCIATED MEASURE
STR-1483-97-BE

## EUROPEAN NETWORK FOR RATIONALISATION OF URBAN TRANSPORT AND ENERGY

Moving to a better, cleaner and more cost-effective local transport system is one of the major challenges faced by local authorities today. In programmes such as THERMIE, and those in the Member States themselves, much is being done towards improving the energy efficiency of transport which could be considered "good practice".

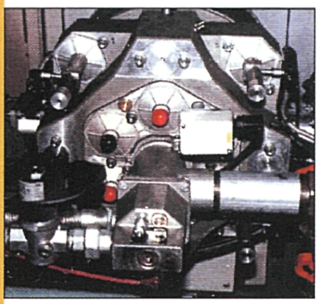
This project aimed to collect and collate this information, and disseminate it to as wide an audience as possible, via a conference and other information tools, such as a CD-ROM. Experience and information on issues such as commuting, public transport systems, alternative technologies for vehicles and other issues were brought together into a Good Practice Guide and an Action Plan. The work is being presented at a European conference, planned for April 1999, in Athens, Greece.

**THERMIE support:**
**ECU 199,000**



DEMONSTRATION PROJECT
IN/00028/97

## INTEGRATED SYSTEM TO RECOVER PROCESS HEAT AND WATER IN A CERAMIC SPRAY DRYER WITH HEAT EXCHANGERS AND ABSORPTION



In the manufacture of ceramic tiles, the process of spray drying ceramic raw materials is particularly energy intensive. If new systems can be designed to improve this process, without affecting the production cycle, then the resulting financial and environmental benefits will be substantial.

This project applied the use of advanced heat exchangers, coupled with the incorporation of an absorption system to reduce energy losses during spray drying, to minimise losses from the kiln flue gases and improve the efficiency of the gas turbines.

A two-stage recovery process was designed as a consequence of the project. First, a gas-water heat exchanger was used to heat part of the water that supplied the refrigerator units, followed by a gas-air exchanger that enabled the production of hot air for drying the tiles. Second, direct recovery of the latent heat and water was achieved via direct introduction of water into the exchange tower and recirculation of the water condensed for wet grinding.

Consequent savings of some 25% of total process water consumption were achieved, along with a reduction in $CO_2$ emissions, proportional to the amount of heat recovered.

| | |
|---|---|
| **Participating countries:** | **Italy, Spain, United Kingdom** |
| **Total costs:** | **ECU 1.2 million** |
| **THERMIE support:** | **ECU 0.3 million** |


DEMONSTRATION PROJECT
TR/00037/97

## NATURAL GAS VEHICLES FOR EUROPEAN CITIES AND THEIR INTEGRATION WITH URBAN TRAFFIC MANAGEMENT

With over 80% of the EU's population living in urban areas, and with the continued reliance on the motor vehicle for private and freight transport, the pressure to reduce pollution from this sector and ameliorate congestion is intense. It has been estimated that almost all of the carbon monoxide in our cities comes from transport sources, together with about 60% of the concentrations of NOx and other particulates.

Natural gas can be used as a fuel for many different types of transport application – from conventional and articulated buses, taxis, waste disposal trucks and freight vehicles, through to the private car itself. This project demonstrated the viability of many of these applications through the production and operation of some 235 natural gas vehicles (NGVs). A variety of different types of system has been demonstrated for the first time in Europe, including the use of liquefied-to-compressed natural gas, and biogas-utilisation for light and heavy vehicles.

| | |
|---|---|
| **Participating countries:** | **Belgium, Germany, France, Ireland, United Kingdom** |
| **Total costs:** | **ECU 24.2 million** |
| **THERMIE support:** | **ECU 2.0 million** |


DEMONSTRATION PROJECT
TR/00140/97

### *ELECTRIC VEHICLE DELIVERY IN POSTAL ORGANISATIONS*

Fighting air pollution caused by road traffic is a vital issue for European cities. Effective and viable solutions are urgently needed to ensure the future mobility of both passengers and goods. Electric vehicles (EVs) that are capable of operating in sensitive areas such as city centres without creating polluting emissions, can play a major role in this process.

Postal organisations from five EU Member States have joined together to introduce EVs into their professional fleets, with their demanding postal operations. This affords a valuable opportunity to showcase the benefits of these new vehicles to other potential users.

Over a period of two years, about 70 vehicles have been demonstrated in Germany, Sweden, Finland, France and Belgium. Since then, because of the success of the venture, four more postal organisations have joined the project as observers. The project now spans twelve cities across the EU, from Lyon (France) in the south, to Turku (Finland) in the north.

Many of these vehicles are demonstrating their performance in the most punishing of conditions, with temperatures down to -35°C in Finland, and to the most demanding requirements; 15,000 km/yr from each vehicle in the Belgian test fleet.

| | |
|---|---|
| **Participating countries:** | **Germany, Sweden, Finland, France, Belgium** |
| **(Observers:** | **United Kingdom, Ireland, Italy and Portugal)** |
| **Total costs:** | **ECU 3.1 million** |
| **THERMIE support:** | **ECU 1.1 million** |

DEMONSTRATION PROJECT
EI/00117/97

### *MINIMISATION OF TRANSMISSION LOSSES IN REGIONAL POWER SYSTEMS*

In the electricity sector, inefficiency and losses are usually associated with the thermodynamic limitations of the combustion process. It is also important, however, that once the electricity has been generated, further losses are prevented during subsequent transmission and distribution. Moreover, increased trans-European transmission on existing grids, combined with the increase in electricity demand, will lead to increased power losses, thus creating more bottlenecks on the already overloaded transmission lines. Problems will become more serious with the growing public resistance to the visual impact of more overhead electricity lines. This growing tendency can be slowed down and partially limited by implementing new, more cost-effective, advanced control systems and monitoring and management methods to optimise energy flows on existing lines.

The objective of this project is to demonstrate, in Spain and Italy, the possibility of reducing transmission losses by installing an innovative advanced hierarchical voltage control system with four levels – generator, power plant, regional and system grids – that allows continuous reactive power and voltage optimisation. This will permit a reduction of at least 4% in transmission losses leading to energy savings of 16,000 MWh and 24,000 MWh per year in Spain and Italy respectively.

| | |
|---|---|
| **Participating countries:** | **Spain, Italy** |
| **Total costs:** | **ECU 2.8 million** |
| **THERMIE support:** | **ECU 1.1 million** |

ASSOCIATED MEASURE
DIS-1396-97-GR

### *INTERACTIVE MULTIMEDIA ENERGY CONSERVATION TUTORING SYSTEM*

Shortage of skills and lack awareness of the means of implementing energy saving is a key problem facing staff in our industries today. Many people who work in factories and other manufacturing plant are aware of the concept of energy efficiency, and the benefits it brings to a company, but are unsure of how to go about implementing a project. This initiative produced an interactive CD-ROM focusing on energy conservation measures in factories, with information derived from studies and on-site audits in selected industrial sectors.

**THERMIE support:**
**ECU 65,000**

ASSOCIATED MEASURE
SME-1223-97-FR

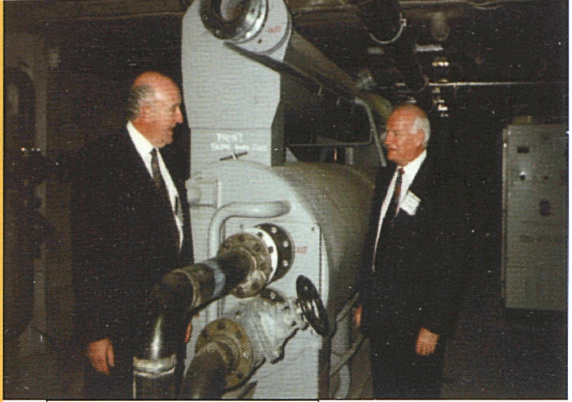
## TRANSFER OF SUCCESSFUL THERMIE TECHNOLOGIES TO SMES: A PILOT STUDY IN THE BUILDING SECTOR

THERMIE has supported many projects to develop the rational use of energy (RUE) in buildings. The objective of this supporting action is to implement a pilot project, aimed at SMEs, to facilitate the transfer of technologies successfully demonstrated through the Programme. The project will help to identify barriers to the transfer of technology to SMEs and promote specially adapted tools to overcome these.

All completed THERMIE projects were reviewed and six successfully demonstrated technologies were selected for a dissemination campaign aimed at SMEs. The six technologies were specially selected to have wide scope for replication and commercialisation by SMEs. The selected technologies include the use of low-cost solar passive technologies in the rehabilitation of social housing, solar heaters for domestic hot water production, the efficient utilisation of artificial light and daylight, integrated systems for the control and metering of heating, a micro-computerised energy management system for use with CHP and air-conditioning systems and a system to control lighting by telephone.

The dissemination activities will raise the awareness of actors in the market, collect information about the major barriers faced by SMEs, develop a methodology to achieve transfer of new technologies to SMEs and, ultimately, facilitate the adoption of an innovative technology by SMEs.

**THERMIE support:**
**ECU 95,000**



DEMONSTRATION PROJECT
BU/00444/92

## INTEGRATION OF A MICRO-COMPUTERISED ENERGY MANAGEMENT SYSTEM WITH CHP AND ABSORPTION CHILLER TO MINIMISE ENERGY USAGE IN AIR-CONDITIONED BUILDINGS

Installation of small-scale Combined Heat and Power (CHP) plants in buildings can minimise use of energy. If used together with air-conditioning systems in an integrated combination, CHP technology can offer even greater improvements in energy efficiency. This project has led to the development of a computerised Energy Management System (EMS), which is used to control and monitor an integrated heating and cooling system comprising a small-scale CHP plant and an absorption chiller. Installed in a hotel in Dublin, with a continuous requirement for both space heating and air-conditioning, the CHP plant is used as the primary source of base load heating and cooling requirements.

In July and August, 1996, a natural gas fuelled CHP plant with a capacity of 710 kWe and 1,040 kWth, and an absorption chiller unit rated at 500 kW, were installed. The CHP unit feeds the absorption chiller with hot water at a temperature of about 120°C, at a flow rate of about 15 litres per second. Development of the advanced software needed to control and monitor the new EMS was completed prior to installation of the plant. The new plant was commissioned in October, 1996, and since then, a programme of monitoring has been underway. The building's old chiller and boiler systems are used as a back-up facility, and are brought into operation by the computerised EMS only when required. The main computer system is located on the CHP unit and it monitors some 90 operating parameters. Results have been excellent and a great deal of interest in replicating the system has been generated.

The successful completion of projects such as this demonstrate best practice in ways to achieve greater energy efficiency by means of integrated processes, more compact equipment and sophisticated computer-controlled management systems.

| | |
|---|---|
| **Participating country:** | **Ireland, United Kingdom, France** |
| **Total costs:** | **ECU 1.3 million** |
| **THERMIE support:** | **ECU 0.5 million** |

DEMONSTRATION PROJECT
BU/00379/95

## REFURBISHMENT OF A HISTORICAL INDUSTRIAL BUILDING AT LAVRIO TO IMPROVE ENERGY EFFICIENCY

Regeneration of old industrial areas and refurbishment of historic buildings can improve the attractiveness of an area and create new employment opportunities. Such activities can also provide the opportunity to install innovative renewable energy technologies and measures to make rational use of energy. Use of these systems can result in a reduction in energy consumption and emissions of $CO_2$, and in enhanced environmental protection.

In this project at Lavrio, a small-scale gas-fired Combined Heat and Power (CHP) plant has been installed to produce electricity and heat for a refurbished building which is part of a new technology park. Space heating is by means of recirculation of air through ducts in the walls and roof. Both walls and roof are insulated and a solar air-heating system has been constructed in the roof. Cooling is achieved by use of absorption chillers using heat recovered from the CHP unit. Lighting is obtained by a combination of natural and artificial lighting, and innovative, transparent, insulation materials are used in the roof and windows to allow natural lighting without compromising energy efficiency. The control of all of the new components is by means of an integrated building management system and any surplus of power or energy will be used by other installations and buildings in the technology park.

Successful demonstration of the innovative technologies used in this project will allow similar projects to capitalise on the expertise gained and multiply the positive impacts on energy conservation, employment and environmental protection.

| | |
|---|---|
| **Participating country:** | **Greece, Germany** |
| **Total costs:** | **ECU 2.6 million** |
| **THERMIE support:** | **ECU 1 million** |

DEMONSTRATION PROJECT
IN/00251/97

## ELECTRICITY FROM LANDFILL GAS: NEW TECHNOLOGIES FOR AN INDUSTRIAL APPROACH

The production of electricity from landfill gas can make a significant contribution to both reducing consumption of fossil fuels and reducing the emissions of greenhouse gases, in this case methane ($CH_4$)and carbon dioxide ($CO_2$). Operational reliability can often be a problem with innovative renewable energy technologies so the aim of this project is not only to produce electricity, but to generate it to meet the same conditions required of conventional power plants; to guarantee to supply 10 MWe, over a period of 10 years, with an operational availability of 95%. The new power plant will be installed at a very large landfill site in the suburbs of Paris.

With an annual waste input to the site of more than 350,000 tonnes, the plant is designed to use gas extracted from the landfill, at about 9,200 cubic metres an hour. The landfill gas, a mixture of $CO_2$ and $CH_4$ will be burned to raise steam in a boiler and the steam will then be fed to a high efficiency steam-turbine connected to an alternator. About 11 MWe will be generated at the alternator terminals. The main aim of the project is to demonstrate 95% or more availability of the plant over a 10 year period. The minimum annual electricity production will therefore be 82,800 MWh. This will be fed to the local distribution network. The project incorporates several technical innovations designed to increase reliability. An innovative burner system allows constant steam production despite fluctuations in the flow-rate and calorific value of the landfill gas. This is possible because a sophisticated monitoring and control system can allow the addition of heavy fuel oil to the burner's fuel-supply as required, although this should constitute less than 5% of the fuel supply.

By demonstrating levels of operational availability comparable to that of conventional power stations, this project will help to break down technical barriers to the greater use of renewable energy technologies.

| | |
|---|---|
| **Participating country:** | **France, Germany** |
| **Total costs:** | **ECU 4.4 million** |
| **THERMIE support:** | **ECU 1.8 million** |

ASSOCIATED MEASURE
DIS-1530-97-DK

## EUROPEAN MARKETING GROUP: DISTRICT HEATING AND COOLING, PHASE 2

This project continues and expands the scope of work of the European Marketing Group on District Heating and Cooling, which was supported by an earlier THERMIE action in this sector. The next stage is to build on the valuable results of Phase 1, by including more organisations in the Group, so that all the major players in the district heating sector are represented. All interested parties can then work together and focus on common goals. The European Heat Metering Association (EHMA), which represents more than 80% of European producers of heat meters, is now included. With the expertise and experience of its constituent organisations at its disposal, the Group will initiate, and contribute to, promotional activities in specific target areas (France, Portugal, and East European countries).

Promotional activities, including events, will increase awareness of the district heating and cooling sector in general and facilitate transfer and implementation of RUE technologies in the targeted countries .

**THERMIE support:**
**ECU 195,000**

ASSOCIATED MEASURE
DIS-1827-98-GB

### JOINT DISSEMINATION OF TARGETED TRANSPORT PROJECTS

THERMIE has, together with its partners, invested substantial resources in large-scale targeted projects in transport and other sectors of the Programme. This has yielded some exciting information which is useful to a wide audience. Now that most of these targeted projects are complete, or nearing completion, the time has come to begin the dissemination of information in earnest. This project will collate the experiences of seven of the projects in the transport sector, and provide for a co-ordinated dissemination campaign using newsletters, brochures, CD-ROM, technical reports and a WWW site.

**THERMIE support:**
**ECU 194,000**

ASSOCIATED MEASURE
SME-1693-98-BE

### OXITRANS – USE OF NEW GAS TURBINES IN RUSSIA

Partial oxidation gas turbines provide for higher efficiencies than their conventional counterparts. This technology, and the experience than goes with it, can be useful in countries outside the EU. This project seeks to transfer this expertise to organisations within the aeronautics industry in Russia, and to encourage the use of Western technologies in the design of aircraft engines.

**THERMIE support:**
**ECU 192,000**

DEMONSTRATION PROJECT
EI/00035/98

### IMPLEMENTING A COGENERATION SCHEME WITH A PARTIAL OXIDATION GAS TURBINE

A recent study, financed by the European Commission, concluded that there is a very real need for new technologies which can improve the efficiency of high-temperature cogeneration (>600°C). This new project, launched this year, provides for the demonstration of an innovative plant comprising a conventional "base" gas turbine (6 MW) with a newer Oxipar gas turbine (1 MW).

The Oxipar turbine is fed with compressed air from the base gas turbine, steam from the boiler and natural gas. It exhausts a combustible gas into a power turbine driving a generator, and then into the burner of a boiler. The effect of the integrated system is to raise the electrical efficiency from 18% to nearly 21%, for the same 80% global thermal efficiency. Expected costs per kW installed are about 20% lower than those of equivalent conventional systems.

| | |
|---|---|
| **Participating countries:** | **Belgium , Italy** |
| **Total costs:** | **ECU 5.4 million** |
| **THERMIE support:** | **ECU 1.6 million** |

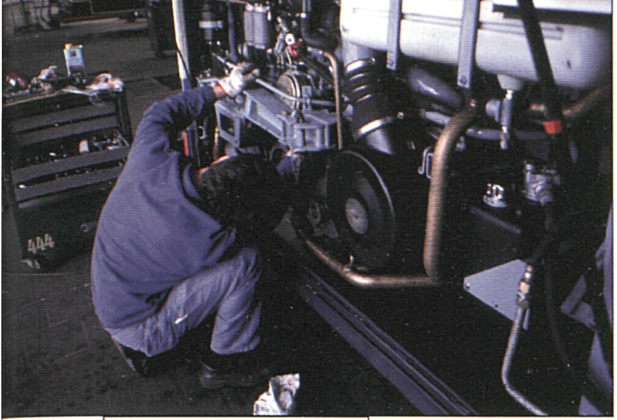
DEMONSTRATION PROJECT
BU/00163/98

### COMPUTER INTEGRATED BUILDINGS

Many technologies and techniques are available to achieve reduced energy consumption and greater energy efficiency in buildings. This project aims to demonstrate how, by using new methodologies and approaches to integrate individual systems, the benefits can be maximised. In this project, Computer Integrated Building (CIB) techniques will be used to integrate individual systems and reduce energy consumption for lighting, heating, cooling, ventilation and building controls. The features to be incorporated include advanced daylighting systems, more efficient components for artificial lighting, natural passive systems for cooling at night and better standards for insulation.

Concepts and strategies will be promoted to minimise overall energy use and achieve reductions of up to 30% of existing demand. New construction materials that provide low energy consumption and minimal environmental impact will also be promoted, as will training courses for equipment maintenance and energy management. The results will be reduced energy use, increased energy efficiency and sound use of renewable energy technologies, with automatic controls to reduce $CO_2$ emissions.

| | |
|---|---|
| **Participating countries:** | **Italy, Spain, Greece** |
| **Total costs:** | **ECU 1.3 million** |
| **THERMIE support:** | **ECU 0.4 million** |



DEMONSTRATION PROJECT
TR/00193/98

### VELAPAC (VEHICULE LEGER A PILE A COMBUSTIBLE)

Electric vehicles offer many potential benefits to society at large: zero emissions, low noise signature and ease of use, for example. Development of electric vehicles is presently hampered by the low power to mass ratio of the current technology, based on rechargeable batteries. Lengthy recharge times are also a major problem. The use of hydrogen fuel cells offers the most promising future for electric vehicles.

The aim of the VELAPAC Project is to demonstrate the successful operation of a fleet of light electric vehicles powered by fuel cells. The automotive industry has invested much R&D effort in the development of fuel cells for electric cars, but only limited effort has focused on small work vehicles and VELAPAC is designed to fill this gap. The work will concentrate on the types of vehicles operated in fleets by specific organisations in cities, at airports and in the postal services, for example. In these settings, important operational problems such as refuelling, maintenance and safety can be addressed.

The main technologies selected for demonstration are Proton Exchange Membrane fuel cells, gaseous hydrogen reservoirs and refuelling by tank-exchange. The first phase of the project will be the production of two "basic" vehicles. Potential users of the new vehicles will be contacted and involved in the development process.

| | |
|---|---|
| **Participating countries:** | **France, Italy** |
| **Total costs:** | **ECU 3.0 million** |
| **THERMIE support:** | **ECU 1.2 million** |

DEMONSTRATION PROJECT
IN/00247/98

### CARBON BLACK AND HYDROGEN PROCESS

This project will demonstrate the potential of the Carbon Black and Hydrogen (CB&H) process developed by Kværner, with the aim of producing Carbon Black from natural gas using 43% less energy than before. This will be achieved through a higher carbon efficiency in the CB&H process. Moreover, the hydrogen in the fuel is not converted to steam and so is available as an energy and/or feedstock. Two further aims of the project are: to introduce hydrogen, at a concentration of 8% by volume, into the natural gas grid in The Netherlands, thus opening the way for a hydrogen economy; and to validate the economic viability of this technology elsewhere in Western Europe.

| | |
|---|---|
| **Participating countries:** | **The Netherlands, Norway** |
| **Total costs:** | **ECU 5.1 million** |
| **THERMIE support:** | **ECU 1.7 million** |

ASSOCIATED MEASURE
DIS-1891-98-DE

### DISSEMINATION OF ADVANCED COMBUSTION TECHNOLOGY FOR HIGH-TEMPERATURE PROCESSES IN SMEs

Many demonstration projects have highlighted the benefits of FLOX compact regenerative burners (higher efficiencies, lower NOx) in sectors such as steel annealing. This information and expertise needs to be more widely disseminated to organisations in this and other industrial sectors. This action will identify the specific demand and technical requirements from different industries, study technical feasibility, set up lab-scale demonstrations and generally encourage replication.

**THERMIE support:**
**ECU 137,000**

ASSOCIATED MEASURE
STR-2053-98-PT

### POTENTIALITIES FOR RATIONAL USE OF ENERGY IN CUBA

The aim of this project is to assess the need for investment in rational use of energy (RUE) technologies, and its potential, in the Cuban hotel sector. The results of the study will be widely disseminated to promote RUE in the sector and to highlight European technologies and techniques.

This study will start by making an assessment of the market potential for RUE technologies in Cuba. The institutional and legal framework for co-operation between Cuba and the EU will be examined, and two guides to investment opportunities, aimed at Cuban and European market actors, will be produced. A seminar will be held to promote RUE technologies in the hotel sector in Cuba and the proceedings will be published. Finally, an assessment of the impact of the project will be produced.

It is expected that, as a result of the study, several joint ventures will be formed between European manufacturers and investors and Cuban organisations to facilitate technology transfer. The availability of the guides and brochures produced will make it easier to promote potential RUE projects amongst Cuban and European companies.

**THERMIE support:**
**ECU 98,000**

ASSOCIATED MEASURE
SME-1486-97-IT

### GATE 2020 – GAS ADVANCED TECHNOLOGY FOR EUROPE 2020

This project will assess existing and emerging technologies for the supply and utilisation of natural gas in Europe. A research and development strategy will be identified which, if implemented, could accelerate the trend of increasing use of natural gas. Increased use of gas would result in reductions in emissions of $CO_2$; this project will assess the possible benefits of such a scenario to the economy, the environment and industry.

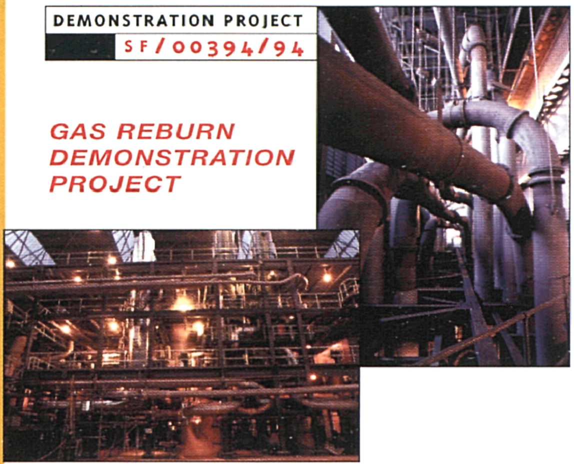
The technology areas that will be studied include: gas production and processing, gas transportation, LNG (liquefied natural gas), vehicles powered by natural gas, gas liquids and underground storage. Dissemination of the results of the research will encourage co-operation among European companies and organisations to develop natural gas technologies and take part in industrial initiatives.

**THERMIE support:**
**ECU 225,000**



DEMONSTRATION PROJECT
SF/00394/94

### GAS REBURN DEMONSTRATION PROJECT

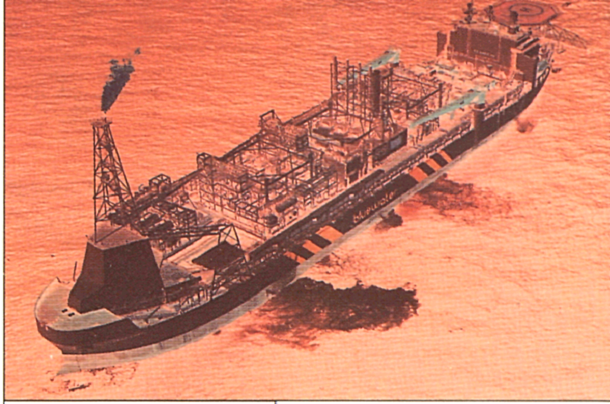


The electricity generation market will continue to be dominated by the use of solid fuels such as coal, at least over the next few years. With the pressures growing to safeguard our environment from the damage caused by climate change and acid deposition, cleaner and more efficient combustion is vital.

Gas reburn is a technique to reduce the emissions of one of the main sets of gases responsible for acid deposition; the oxides of nitrogen (NOx). The technique has been proven on pilot and small-scale plants, but never before on a coal burning, wall-fired front boiler in Europe.

Gas reburn was applied initially to one of the four 1,550 MWth front wall, dry bottom pulverised fuel fired boilers at Longannet Power Station, owned and operated by Scottish Power. An initial feasibility study undertaken in 1993 confirmed the technical and economic merits of the new system, relative to an alternative of using selective non-catalytic reduction. By the end of 1996, the bulk of the installation work was complete.

| | |
|---|---|
| **Participating countries:** | **United Kingdom, Ireland, Italy, France** |
| **Total costs:** | **ECU 17.5 million** |
| **THERMIE support:** | **ECU 7 million** |



DEMONSTRATION PROJECT
OG/00062/96

### FLOATING PRODUCTION STORAGE AND OFFLOADING (FPSO) INTEGRITY

FPSO units are one of the best solutions available to exploit oil fields located in deep water areas which are too remote to allow economically-viable development by means of fixed, and permanent, production facilities and sub-sea pipelines. Such units, with a large storage capacity, can move from field to field loading oil to take back to shore. They are set to play an increasing role in the development of small fields in the northern North Sea and, as the focus of oil exploration moves from the North Sea to the deeper waters and harsher conditions of the Atlantic, the exploitation of large new fields to the west of Shetland.

The structural integrity of the FPSO vessels is of vital importance in terms of safety, environmental protection and economics and so this project carried out a monitoring programme to measure hull stresses, motions, loads on the mooring turret and anchor lines and sea conditions. A robust monitoring system was installed on board the new FPSO vessel "Glen Dowr", stationed in the Northern North Sea, at the Durward and Dauntless fields operated by oil company Amerada Hess. Production started in August 1997, and the first monitoring data was collected in October, 1997. The programme will run for two and a half years and data are continuously processed, analysed and reported.

The results of this project will provide a better understanding of the effects of the harsh operating conditions on the structural integrity of FPSO vessels and lead to improvements in their design, engineering and inspection. This, in turn, will allow their continued and more widespread use to increase the amount of oil recovered, enhance Europe's security of energy supply and ensure that we remain at the cutting edge of new technology in this field.

| | |
|---|---|
| **Participating country:** | **The Netherlands, France** |
| **Total costs:** | **ECU 1.8 million** |
| **THERMIE support:** | **ECU 0.6 million** |

DEMONSTRATION PROJECT
OG/00124/98

### FIELD VERIFICATION OF NUCLEAR MAGNETIC RESONANCE LOGGING-WHILE-DRILLING SYSTEM

Once an exploration well has been drilled to locate new oil and gas reservoirs, wireline logging instruments are usually deployed, down-hole, to compile vertical profiles (logs) of the petrophysical properties of the rock formations encountered. This data allows geologists and engineers not only to determine if any hydrocarbons are present, and to map the extent and size of new fields, but also gives an indication of likely productivity. Since the 1980s, various types of wireline tools have been developed to be incorporated into the drilling assembly, behind the drill-bit, so that data can be sent to the surface during drilling. This allows much quicker evaluation of formations and so saves time and drilling costs.

Logging tools to measure nuclear magnetic resonance (NMR) have been used in traditional logging operations for many years, but the aim of this project is to develop and evaluate a commercial LWD (logging-while-drilling) NMR tool. The new tool will measure the magnetic resonance relaxation curve of the rock surrounding the drill and, from this, computer analysis will provide a rapid evaluation of total and free fluid porosity. Successful demonstration of the new service will provide enhanced, real-time, petro-physical evaluations of hydrocarbon-bearing reservoirs and thus help to optimise recovery rates through faster and more accurate predictions of reserves and productivity.

| | |
|---|---|
| **Participating countries:** | **Germany, United Kingdom** |
| **Total costs:** | **ECU 6.12 million** |
| **THERMIE support:** | **ECU 2.4 million** |

DEMONSTRATION PROJECT
SF/00243/98

### DEMONSTRATION OF REGENERATIVE PROCESS WITH $SO_2$/NOx REMOVAL (SNAP SYSTEM)

Sulphur dioxide and the oxides of nitrogen are two of the main pollutants which result from the combustion of solid fuels such as coal. This project aims to demonstrate, for the first time at commercial-scale, an innovative, regenerative system which results in their removal whilst allowing for the recovery of sulphur, which can then be sold as a useful by-product. The project aims to achieve removal efficiencies of 95% for $SO_2$ and 80% for NOx.

The major components of the SNAP system will be an adsorption section (consisting of a gas suspension adsorber), the regeneration section (with a sorbent heater), a regenerator and sorbent cooler, and by-product recovery in the Claus plant. Another important aim of this project is to demonstrate the commercial benefits and technical performance of this kind of new system.

| | |
|---|---|
| **Participating countries:** | **Denmark, United Kingdom, Belgium** |
| **Total costs:** | **ECU 17.2 million** |
| **THERMIE support:** | **ECU 5.1 million** |

ASSOCIATED MEASURE
DIS-1491-97-GB

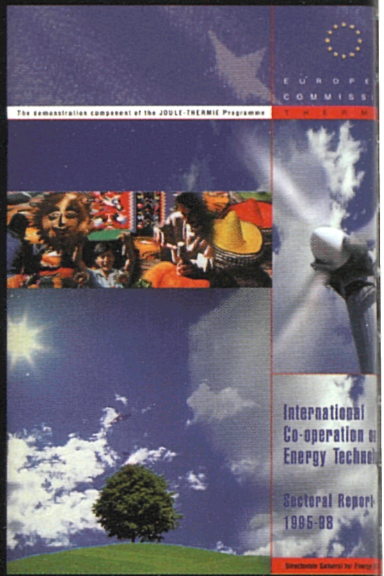
### EVALUATION OF FLUE GAS DESULPHURISATION TECHNOLOGY FOR CHINESE COAL-FIRED POWER PLANTS

In Europe we have a great deal of expertise in reducing the emissions of harmful pollutants, such as SO2. This knowledge and experience can be useful to other countries, none more so than China, which uses substantial quantities of coal for electricity generation, and has a rapidly growing demand for new capacity. The use of flue gas desulphurisation (FGD) technologies can cut emissions by upwards of 80 to 90%. This project will assess the technical and economic viability of, and potential for, the application of FGD systems in China, and seek to stimulate technology transfer and trade. A follow-on demonstration project in China is envisaged.

**THERMIE support:**
**ECU 70,000**

ASSOCIATED MEASURE
DIS-1647-98-ES
STR-1712-98-DE

## DISSEMINATION ACTIVITIES ASSOCIATED WITH THE PUERTOLLANO IGCC PLANT AND RELATED PROJECTS/ IMPROVEMENT OF THE EFFICIENCY AND ECONOMICS OF IGCC POWER PLANTS BY OPTIMISATION OF THE BOTTOMING CYCLE


A significant proportion of Europe's electricity is produced from coal, a relatively "dirty" fuel in terms of emissions of pollutants. THERMIE has, for many years, supported the development of new technologies for coal-fired power plants, which can deliver increased efficiency and lower levels of emissions. One such technology is the advanced IGCC (integrated gasification combined cycle) power plant. In this process coal is gasified, the resulting gas used to drive a gas turbine to generate electricity and waste heat is used to drive a conventional steam cycle to provide a secondary source of electricity generation. This combined cycle results in very high energy conversion efficiencies (over 50%).

To encourage the development of IGCC technology, the EU supported the construction of a demonstration plant at Puertollano, near Madrid. Two closely-linked THERMIE projects will now build on the success of this plant: the first project will provide, to a world-wide audience, up-to-date information about the achievements of the Puertollano IGCC plant and the other, as well as disseminating the results, and those of a sister plant at Buggenum in The Netherlands, will continue to develop the new technology, in particular with respect to gas turbine technology, to increase efficiency even more. Further improvements in efficiencies hold the key to wider implementation of IGCC power plants.

The results of the project at the Puertollano power plant will be disseminated using a variety of the latest media, (a CD-ROM, web page and newsletter), conferences and seminars will be held for technical audiences, an information centre will be set up and tours of the plant will be conducted.

**Participating countries:**
**Spain, Portugal, Germany**
**THERMIE support:**
**ECU 400,000**

# TRANS-SECTORAL AND STRATEGIC ACTIVITIES

In addition to the sectoral activities, THERMIE has also contributed to actions which span more than one sector, or which are aimed at supporting a wider, more strategic objective, such as for increased international co-operation. Some examples of projects in these areas are highlighted below.

## International Co-operation

ASSOCIATED MEASURE
DIS-1190-97-GB

### *OPERATION OF THE SOUTHERN AFRICA RENEWABLE ENERGY INFORMATION NETWORK (SAREIN)*

Demand for electricity in Southern Africa is increasing, in both rural and urban areas. In the light of the $CO_2$ reduction targets set recent during climate change negotiations, and the commitment of Southern African governments to sustainable development and sustainable economic growth, interest in renewable sources of energy is growing. This opens up significant opportunities for the development of renewables, particularly for off-grid applications in rural areas, but also for on-grid systems, to satisfy the growing energy demand in an environmentally-sustainable manner.

Consequently, THERMIE has been supporting the establishment and operation of a unique network across the countries of Southern Africa. To date, the network has been successful in identifying and promoting investment opportunities, in encouraging partnerships between industry and the public sector, in providing information on the technologies and on financing, and in raising general awareness of renewables. One concrete example is the recent announcement by the government of the Republic of South Africa, of a new energy policy which foresees a role for renewables.

**THERMIE support:**
**ECU 280,000**

ASSOCIATED MEASURE
DIS-1364-97-GR

### *MODERN FINANCIAL MECHANISMS AND TOOLS FOR THE INTRODUCTION OF CLEAN AND EFFICIENT TECHNOLOGIES IN THE BLACK SEA REGION*

This project supports the modernisation of the energy sectors of the six countries of the Black Sea Region, and has the ultimate aim to achieve compliance with the requirements of the European Energy Charter, and the introduction of clean and efficient technologies, within the context of transition to a free market economy. The objective is to provide information and training to assist the development and implementation of modern financial mechanisms and tools to promote of clean and efficient technologies into markets in the Black Sea Region.

Two workshops were held in November 1998, at the Black Sea Regional Energy Centre in Sofia, Bulgaria, targeted at experts in the energy sector, industry, banks and consulting companies. Topics addressed at the workshops included third party financing, venture capital, revolving funds and interest rate subvention. The results will be widely disseminated and a set of recommendations for actions will be proposed.

These activities will lead to the formation of a nucleus of energy managers from the public and private sectors and policy-makers, together with managers from government and utilities, industry and banks who will be trained in the use of modern financial tools to finance energy investments. Links between the energy and financial sectors in the EU and the Black Sea Region will be enhanced.

**THERMIE support:**
**ECU 73,000**

ASSOCIATED MEASURE
SME-1904-98-FR

### *DESIGN OF LARGE-SCALE PHOTOVOLTAIC PROGRAMMES – A WATER PUMPING PROGRAMME IN INDIA*

Water requirements in India are enormous. It is estimated that nearly one-quarter of all rural households (some 175 million) are without water supply. Moreover, where a viable water supply does exist, the needs of agriculture are often paramount, as such use provides much needed resources. Many households are remote, with little or no access to a conventional electricity supply grid, so conventional systems for pumping water are not an option.

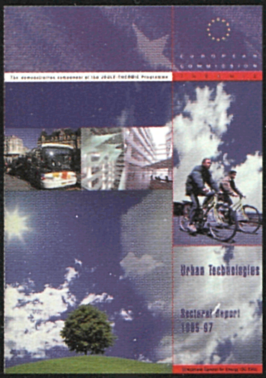
This project studies the role of photovoltaics (PV) for water pumping, mainly in the regions of Karnataka and Rajasthan.

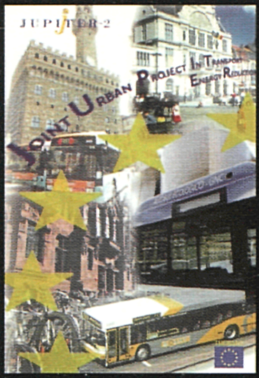
By studying issues of:

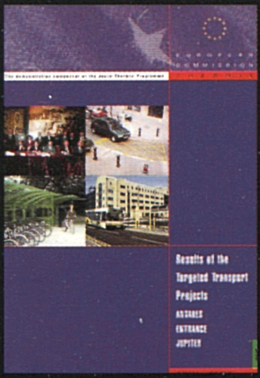
- technical management and maintenance,
- financing, and
- localised partnerships,

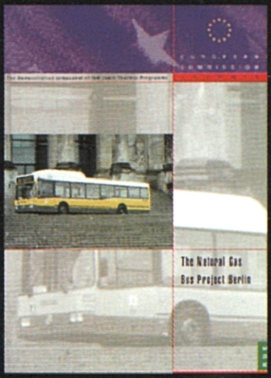
it is hoped that the project will result in the design a large-scale PV water pumping programme for these remote areas, and raise awareness of the potential of this technology amongst the wider international community, and funding agencies in particular.

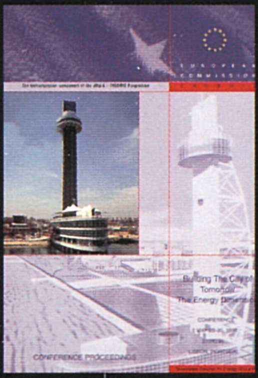
**THERMIE support:**
**ECU 250,000**











## Urban technologies

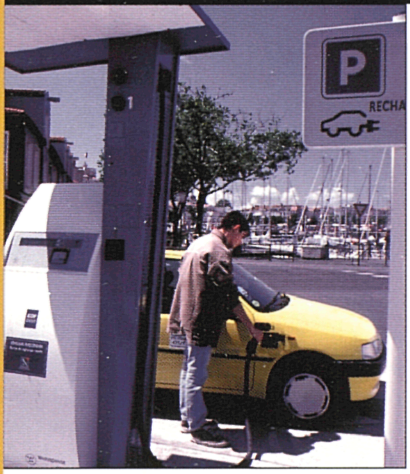
It is estimated that over 80% of the population in Europe live and work in cities. Moreover, if you include the proportion of people who travel in and out of a city for the purposes of work or leisure, then their importance as a focus for efforts is clear. With such large urban populations, the relative energy demand is correspondingly high. Some 75% of all energy demand is thought to be accounted for within the confines of our cities. Even outside of energy matters, the economic importance of urban life is high, with public sector contracts and procurements for infrastructure in cities accounting for nearly 15% of gross domestic product of the EU.

The pressures on urban lifestyles are increasing dramatically. In the middle of this century, the world's population was some 2.6 billion, who between them owned 50 million cars. Now, only 40 to 50 years later, population has doubled and car ownership has increased by 1,000%

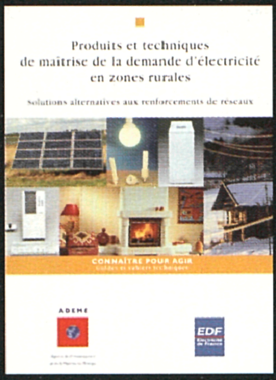
THERMIE has responded to just these kind of challenges and, throughout the four years of the Programme, has concentrated its resources on urban issues and technologies such as energy use in buildings, improved transport systems and city-friendly forms of energy generation and supply such as Combined Heat and Power.

In 1998, a major conference was held in Lisbon, Portugal (May 1998) on, "Building the City of Tomorrow – the Energy Dimension". This event brought together well over 200 delegates from across the EU. Various urban-related initiatives, such as the targeted projects from the building and transport sectors, were highlighted. In total, seven targeted projects about transport, with EC support totalling ECU 35 million, and eight about buildings, with EC support of some ECU 21 million, were presented. In total, over 100 cities around the EU took part in these projects.

The impact of these various projects has been significant. For example, in one transport project, over 1,200 low or zero-emission electric vehicles were developed and used which, together, saved some 4.6 mtoe of energy demand, 14.2 kt of $CO_2$, 30 t of CO and 115 t of NOx . Alternatively, in one of the building projects, projected energy demands were reduced by 50%, with subsequent savings in $CO_2$ emissions of between 50% and 75%. In a different buildings project, the fuel costs for lighting, heating etc., were reduced by up to 75%. All of these impacts are in addition to a more general improvement in "service" provision, comfort levels etc.






## The OPET Network in 1998

The year 1998 was the second successive year of joint DG XIII/DG XVII support for the new OPET Network. Now comprising 41 Organisations for the Promotion of Energy Technology in Europe, and 13 Fellow Members (FEMOPETs) of the Network in the Countries of Central and Eastern Europe, the Network's activities continued to grow and expand. During the year, EC support to the OPETs totalled just over ECU 2 million, with a further ECU 1.6 million for the FEMOPETs.

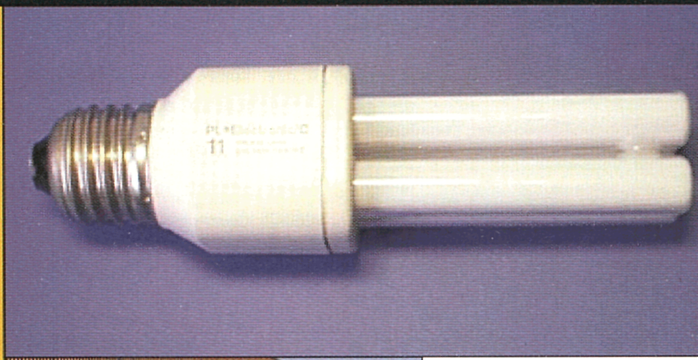
After an initial period to establish the Network, and to forge contacts and partnerships at the local, regional and national levels with key market actors such as industry and public authorities, the members of the Network have further concentrated on the transnational benefits of such a Network.

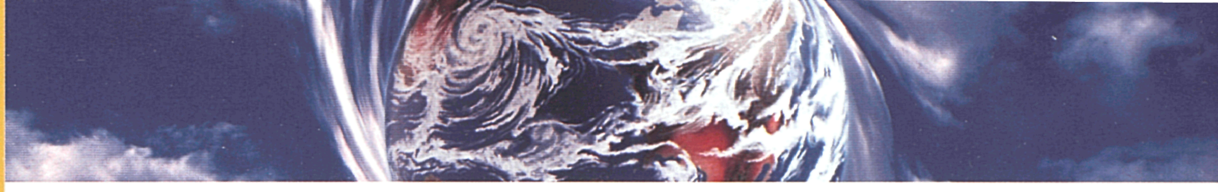
The "raison d'être" for OPETs and FEMOPETs is to work with organisations and individuals in their area to assist them with the take-up of new technologies, in accessing EC support and in developing contacts in other countries. The newly integrated FEMOPETs offer a quite unique opportunity to link East and West, to the mutual benefit of all. These links were strengthened through the 2nd Annual General Meeting of the Network held in Lisbon, Portugal (September 1998) and the Kick-Off Meeting for FEMOPETs, held in Brussels, Belgium (October 1998).

The impact of the Network's activities can be felt in many areas. One of the key activities of OPETs and FEMOPETs is to encourage external contacts to extract maximum benefit from EC support measures, such as the JOULE-THERMIE Programme. A recent analysis estimated that, as a direct consequence of the activities of OPETs and FEMOPETs in their regions, over 100 proposals were submitted to this Programme, with nearly three in ten receiving funding.

In terms of technological take-up, the results are also promising, even in this the second year of a three year programme of actions. The same analysis pointed to over 240 examples of one-to-one discussions between the members of the Networks and companies in their area. As a result of the technical advice given, over 40 bodies had moved on to incorporate the technology or application. A further, specific example, is that of an OPET that has been working with electricity utilities to encourage sales of low-energy light-bulbs. To date over 100,000 have been sold.

These examples, and many more, as well as details of the Network's activities, can be obtained by contacting the OPETs and FEMOPETs in the Network (*see below for contact details*) or by browsing the Network's website: http://www.cordis.lu/opet/home.html





**The OPETs**

**ADEME**
27, rue Louis Vicat
F-75737 Paris
France
Manager: Mr Yves Lambert
Contact: Ms Florence Clement
Telephone: +33 1 47 65 20 41
Facsimile: +33 1 46 45 52 36
E-mail:
florence.clement@ademe.fr

**ASTER-CESEN**
Via Morgagni 4
I-40122 Bologna
Italy
Manager: Ms Leda Bologni
Contact: Ms Verdiana Bandini
Telephone: +39 51 236242
Facsimile: +39 51 227803
E-mail: opet@aster.it

**BEO**
c/o Projekttrager Biologie, Energie, Umwelt
Forschungszentrum Jülich GmbH
D-52425 Jülich
Germany
Manager: Mr Norbert Schacht
Contact: Mrs Gillian Glaze
Telephone: +49 2461 615928
Facsimile: +49 2461 612880
E-mail: g.glaze@fz-juelich.de

**BRECSU**
Bucknalls Lane, Garston
WD2 7JR Watford
United Kingdom
Manager: Mr Mike Trim
Contact: Mr Mike Trim
Telephone: +44 1923 664754
Facsimile: +44 1923 664097
E-mail: trimm@bre.co.uk

**CCE**
Estrada de Alfragide, Praceta 1
P-2720 Alfragide
Portugal
Manager: Mr Luis Silva
Contact: Mr Diogo Beirao
Telephone: +351 1 4718210
Facsimile: +351 1 4711316
E-mail: dmre.cce@mail.telepac.pt

**CLER**
28 rue Basfroi
F-75011 Paris
France
Manager: Ms Liliane Battais
Contact: Mr Richard Loyen
Telephone: +33 1 46590444
Facsimile: +33 1 46590392
E-mail: cler@worldnet.fr

**CMPT**
Offshore Technology Park,
Exploration Drive
AB23 8GX Aberdeen
United Kingdom
Manager: Mr Jonathan Shackleton
Contact: Ms Jane Kennedy
Telephone: +44 1224 853440
Facsimile: +44 1224 706601
E-mail: j.kennedy@cmpt.co.uk

**CORA**
Altenkesselerstrasse 17
D-66115 Saarbrucken
Germany
Manager: Mr Michael Brand
Contact: Mr Nicola Sacca
Telephone: +49 681 9762 174
Facsimile: +49 681 9762 175
E-mail: sacca@sea.sb.eunet.de

**CRES**
19 km Marathonos Ave
GR-190 09 Pikermi
Greece
Manager: Ms Maria Kontoni
Contact: Ms Maria Kontoni
Telephone: +30 1 60 39 900
Facsimile: +30 1 60 39 911
E-mail:
mkontoni@cresdb.cress.ariadne-t.gr

**Cross Border OPET- Bavaria-Austria**
Wieshuberstr. 3
D-93059 Regensburg
Germany
Manager: Mr Johann Fenzl
Contact: Mr Toni Lautenschlaeger
Telephone: +49 941 46419-0
Facsimile: +49 941 46419-10
E-mail: fenzl.zreu@t-online.de

**ENEA**
CR Casaccia
S Maria di Galeria
I-00060 Roma
Italy
Manager: Mr Francesco Ciampa
Contact: Ms Simona Fumagalli
Telephone: +39 6 3048 4118
Facsimile: +39 6 3048 4447
E-mail:
enea_opet@casaccia.enea.it

**Energy Centre Denmark**
DTI
P.O. Box 141
DK-2630 Taastrup
Denmark
Manager: Mr Poul Kristensen
Contact: Mr Nils Daugaard
Telephone: +45 43 50 70 80
Facsimile: +45 43 50 70 88
E-mail: nda@dti.dk

**ETSU**
Harwell
Didcot
OX11 0RA Oxfordshire
United Kingdom
Manager: Ms Cathy Durston
Contact: Ms Lorraine Watling
Telephone: +44 1235 432014
Facsimile: +44 1235 433434
E-mail:
lorraine.watling@aeat.co.uk

**EVE**
Edificio Albia I planta 14,
C. San Vicente, 8
E-48001 Bilbao
Spain
Manager: Mr Jesus Mari Giori
Contact: Mr Juan Reig Giner
Telephone: +34 94 423 50 50
Facsimile: +34 94 424 97 33
E-mail: jreig@eve.es

**FAST**
2, P. le R. Morandi
I-20121 Milan
Italy
Manager: Ms Paola Gabaldi
Contact: Ms Paola Gabaldi
Telephone: +39 02 76 01 56 72
Facsimile: +39 02 78 24 85
E-mail: paola.gabaldi@fast.mi.it

**GEP**
45, rue Louis Blanc
F-92038 Paris, La Defense Cedex
France
Manager: Mr Michel Ningler
Contact: Ms Nadine Monpert
Telephone: +33 1 47 17 68 65
Facsimile: +33 1 47 17 67 47
E-mail: gep@gep-france.com

**ICAEN**
Avinguda Diagonal, 453 bis, atic
E-08036 Barcelona
Spain
Manager: Mr Joan Josep Escobar
Contact: Mr Joan Josep Escobar
Telephone: +34 93 4392800
Facsimile: +34 93 4197253
E-mail: edificis@icaen.es

**ICEU**
Auenstrasse 25
D-04105 Leipzig
Germany
Manager: Mr Jöeg Matthies
Contact: Mrs Petra Seidler
Telephone: +49 341 9804969
Facsimile: +49 341 9803486
E-mail: krause@iceu.manner.de

**ICIE**
Via Velletri, 35
I-00198 ROMA
Italy
Manager: Ms Mariella Melchiorri
Contact: Mrs Rosella Cicarelli
Telephone: +39 6 8549141-8543467
Facsimile: +39 6 8550250
E-mail: icie.rm@rm.icie.it

**IDAE**
Paseo de la Castellana 95, planta 21
E-28046 Madrid
Spain
Manager: Mr José Donoso Alonso
Contact: Ms Virginia Vivanco Cohn
Telephone: +34 91 456 5024
Facsimile: +34 91 555 1389
E-mail: vvivanco@idae.es

**IMPIVA**
Plaza Ayuntamiento, 6
E-46002 Valencia
Spain
Manager: Mr José-Carlos Garcia
Contact: Mr Joaquin Ortola
Telephone: +34 96 398 6336
Facsimile: +34 96 398 6201
E-mail:
ximo.ortola@impiva.m400.gva.es

**Institut Wallon**
Boulevard Frère Orban 4
B-5000 Namur
Belgium
Manager: Mr Francis Ghigny
Contact: Mr Xavier Dubuisson
Telephone: +32 81 25 04 80
Facsimile: +32 81 25 04 90
E-mail:
xavier.dubuisson@iwallon.be

**Irish Energy Centre**
Glasnevin
IE-Dublin 9
Ireland
Manager: Ms Rita Ward
Contact: Ms Rita Ward
Telephone: +353 1 8082073
Facsimile: +353 1 8372848
E-mail: opetiec@irish-energy.ie

**LDK**
7, Sp. Triantafyllou St.
GR-113 61 Athens
Greece
Manager: Mr Leonidas Damianidis
Contact: Ms Marianna Kondilidou
Telephone: +30 1 8563181
Facsimile: +30 1 8563180
E-mail: ldkopet@mail.hol.gr

**NIFES**
8 Woodside Terrace
G3 7UY Glasgow
United Kingdom
Manager: Mr Andrew Hannah
Contact: Mr John Smith
Telephone: +44 141 332 4140
Facsimile: +44 141 332 4255
E-mail: glasgow@nifes.co.uk

**Novem**
Swentiboldstraat 21, P.O. Box 17
NL-6163 AA Sittard
Netherlands
Manager: Mr Theo Haanen
Contact: Mrs Antoinette Deckers
Telephone: +31 46 42 02 326
Facsimile: +31 46 45 28 260
E-mail: A.Deckers@Novem.nl
E-mail: T.Haanen@Novem.nl

**NVE**
P.O. Box 5091, Majorstua
N-0301 Oslo
Norway
Manager: Mr Roar W Fjeld
Contact: Mrs Marianne Kramer
Telephone: +47 22 95 90 54
Facsimile: +47 22 95 90 99
E-mail: rwf@nve.no

**OPET Austria**
Linke Wienzeile 18
A-1060 Vienna
Austria
Manager: Mr Guenter Simader
Contact: Mr Guenter Simader
Telephone: +43 1 586 15 24 ext 21
Facsimile: +43 1 586 94 88
E-mail: simader@eva.wsr.at

**OPET EM**
Swedish National Energy
Administration, Box 591
S-101 31 Stockholm
Sweden
Manager: Ms Sonja Ewerstein
Contact: Mr Anders Haaker
Telephone: +46 70 648 6919
Facsimile: +46 8 24 5014
E-mail: sonja.ewerstein@stem.se

**OPET Finland**
Technology Development Centre
Tekes
P.O. Box 69,
Malminkatu 34
FIN-0101 Helsinki
Finland
Manager: Ms Marjatta Aarniala
Contact: Ms Marjatta Aarniala
Telephone: +358 105215736
Facsimile: +358 105215908
E-mail: marjatta.aarniala@tekes.fi

**OPET Israel**
Tel-Aviv University
IL-69978 Tel Aviv
Israel
Manager: Mr Yair Sharan
Contact: Mr Yair Sharan
Telephone: +972 3 6407573
Facsimile: +972 3 6410193
E-mail: sharany@post.tau.ac.il

**OPET Luxembourg**
Avenue des Terres Rouges 1
L-4004 Esch-sur-Alzette
Luxembourg
Manager: Mr Jean Offermann
(Agence de l'Energie)
Contact: Mr Ralf Goldmann
(Luxcontrol)
Telephone: +352 547 711 282
Facsimile: +352 547 711 266
E-mail: goldmann@luxcontrol.com

**OPET Norrland**
Norrlandsgatan 13, Box 443
S-901 09 Umea
Sweden
Manager: Ms France Goulet
Contact: Mr Anders Lidholm
Telephone: +46 94 11 08 33
Facsimile: +46 90 16 37 19
E-mail: opet.venet@swipnet.se

**Orkustofnun**
Grensasvegi 9
IS-108 Reykjavik
Iceland
Manager: Mr Einar Tjörvi Eliasson
Contact: Mr Einar Tjörvi Eliasson
Telephone: +354 569 6105
Facsimile: +354 568 8896
E-mail: ete@os.is

**PARTEX-CEEETA**
Rua Gustavo de Matos
Sequeira, 28 - 1 . Dt .
P-1200 Lisboa
Portugal
Manager: Mr Anibal Fernandes
Contact: Mr Anibal Fernandes
Telephone: +351 1 395 6019
Facsimile: +351 1 395 2490
E-mail: ceeeta@mail.telepac.pt

**RARE**
50 rue Gustave Delory
F-59800 Lille
France
Manager: Mr Pierre Sachse
Contact: Mr Jean-Michel Poupart
Telephone: +33 3 20 88 64 30
Facsimile: +33 3 20 88 64 40
E-mail: rare@nordnet.fr

**SODEAN**
Isaac Newton s/n
Pabellón de Portugal - Edifico SODEAN
E-41012 Sevilla
Spain
Manager: Mr Juan Antonio
Barragán Rico
Contact: Ms Maria Luisa
Borra Marcos
Telephone: +34 95 4460966
Facsimile: +34 95 4460628
E-mail: mborra.sodean@sadiel.es

**SOGES**
Corso Turati 49
I-10128 Turin
Italy
Manager: Mr Antonio Maria Barbero
Contact: Mr Fernando Garzello
Telephone: +39 11 3190833/3186492
Facsimile: +39 11 3190292
E-mail: opet@grupposoges.it

**VTC**
Boeretang 200
B-2400 Mol
Belgium
Manager: Mr Hubert van den Bergh
Contact: Ms Greet Vanuytsel
Telephone: +32 14 335822
Facsimile: +32 14 321185
E-mail: opetvtc@vito.be

**Wales OPET Cymru**
Dyfi EcoParc
Machynlleth
SY20 8AX Powys
United Kingdom
Manager: Ms Catherine Peasley
Contact: Mr Rod Edwards
Telephone: +44 1654 705000
Facsimile: +44 1654 703000
E-mail: opetdulas@gn.apc.org

## The FEMOPETs

**Black Sea Regional Energy Centre - BSREC**
8, Triaditza Str.
BG-1040 Sofia
Bulgaria
Manager: Dr L. Radulov
Contact: Dr L. Radulov
Telephone: +359 2 980 6854
Facsimile: +359 2 980 6855
E-mail: ecsynkk@bsrec.bg

**EC BREC - LEI FEMOPET**
c/o EC BREC/IBMER
Warsaw Office
ul. Rakowiecka 32
PL-02-532 Warsaw
Poland
Manager: Mr Krzysztof Gierulski
Contact: Mr Krzysztof Gierulski
Telephone: +48 22 484832
Facsimile: +48 22 484832
E-mail: grewis@ibmer.waw.pl

**Energy Centre Bratislava**
c/o SEI-EA
Bajkalská 27
SK-82799 Bratislava
Slovakia
Manager: Mr Michael Wild
Contact: Mr Michael Wild
Telephone: +421 7 52 48 472
Facsimile: +421 7 52 48 470
E-mail: ecbratislava@ibm.net

**Energy Centre Hungary**
Könyves Kálmán Körút 76
HU-1087 Budapest
Hungary
Manager: Mr Andras Szalóki
Contact: Mr Zoltan Csepiga
Telephone: +36 1 313 4824
+36 1 313 7837
Facsimile: +36 1 303 9065
E-mail:
doris.keszthelyi@energy.centre.hu

**Estonia FEMOPET**
Estonian Energy Research Institute
Paldiski mnt.1
EE-0001 Tallinn
Estonia
Manager: Mr Villu Vares
Contact: Mr Rene Tonnisson
Telephone: +372 2 45 0303
Facsimile: +372 631 1570
E-mail: femopet@femopet.ee

**FEMOPET LEI - Lithuania**
Lithuanian Energy Institute
3 Breslaujos Str.
LT-3035 Kaunas
Lithuania
Manager: Mr Romualdas
Contact: Mr Sigitas Bartkus
Telephone: +370 7 35 14 03
Facsimile: +370 7 35 12 71
E-mail: felix@isag.lei.lt

**FEMOPET Poland KAPE-BAPE-GRAPE**
c/o KAPE
ul. Nowogrodzka 35/41 XII p.
PL-00-950 Warsaw
Poland
Manager: Ms Marina Coey
Contact: Ms Marina Coey
Telephone: +48 22 62 22 794
Facsimile: +48 22 62 22 796
E-mail: kape4@pol.pl

**FEMOPET Slovenia**
Jozef Stefan Institute
Energy Efficiency Centre
Jamova 39
SL-1000 Ljubljana
Slovenia
Manager: Mr Boris Selan
Contact: Mr Tomaz Fatur
Telephone: +386 61 1885 210
Facsimile: +386 61 1612 335
E-mail: tomaz.fatur@ijs.si

**Latvia FEMOPET**
c/o B.V. EKODOMA Ltd
Zentenes Street 12-49
LV-1069 Riga
Latvia
Manager: Ms Dagnija Blumberga
Contact: Ms Dagnija Blumberga
Telephone: +371 721 05 97/
+371 241 98 53
Facsimile: +371 721 05 97/
+371 241 98 53
E-mail: ekodoma@mail.bkc.lv

**OMIKK**
National Technical Information
Centre and Library OMIKK
Muzeum Utca 17
HU-1088 Budapest
Hungary
Manager: Mr Gyula Nyerges
Contact: Mr Gyula Nyerges
Telephone: +36 1 2663123
Facsimile: +36 1 3382702
E-mail: nyerges@omk.omikk.hu

**FEMOPET Romania ENERO**
8, Energeticienilor Blvd.
RO-79619 Bucharest 3
Romania
Manager: Mr Alexandru Florescu
Contact: Mr Christian Tintareanu
Telephone: +401 322 0917
Facsimile: +401 322 2790
E-mail: crit@mail.gsci.vsat.ro

**Sofia Energy Centre Ltd**
51, James Boucher Blvd.
BG-1407 Sofia
Bulgaria
Manager: Ms Violetta Groseva
Contact: Ms Violetta Groseva
Telephone: +359 2 96 25158
Facsimile: +359 2 681 461
E-mail: ecencentre@enpro.bg

**Technology Centre AS CR**
Rozvojova 135
CZ-165 02 Prague 6
Czech Republic
Manager: Mr Karel Klusacek
Contact: Mr Radan Panacek
Telephone: +420 2 203 90203
Facsimile: +420 2 325 630
E-mail: klusacek@tc.cas.cz

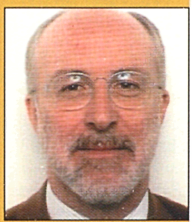
**For further details about the OPET Network please contact:**

**OPET-CU**
13b Avenue de Tervuren
B-1040 Brussels
Belgium
Manager: Mr John Butson
Contact: Ms Jana Hainsworth
Telephone: +32 2 7438930
Facsimile: +32 2 7438931
E-mail: OPET_CU@ecotec.com

**or visit the OPET Web site:**
http://www.cordis.lu/opet/home.html

## WHO'S WHO IN DG XVII/D

### Energy Technology



Director:
**Pedro de Sampaio Nunes**
Fax: +32 2 296.45.74

Unit D 1:
**Pirjo-Liisa Koskimäki**
Strategy, dissemination, promotion
Fax: +32 2 295.61.18

Sectorial Responsibilities:

| | |
|---|---|
| Strategy and OPETs | **J. Bastos** |
| RES | **R. Fabry** |
| Fossil Fuels | **I. Samouilidis** |
| RUE and SMEs | **S. de Royer-Dupré** |
| International Cooperation | **P. Abreu Marques** |

Unit D 2:
**Gonzalo Molina Igartua**
Energy Consumption Technology
Fax: +32 2 296.60.16

Sectorial Responsibilities:

| | |
|---|---|
| Solid Fuels | **J.K. Wilkinson** |
| RUE in Industry | **A. Paparella** |
| Urban Technologies | **A. Landabaso** |
| RUE in Transports | **J.M. Bemtgen** |

Unit D 3:
**Enzo Millich**
Energy Production Technology
Fax: +32 2 296.62.61

Sectorial Responsibilities:

| | |
|---|---|
| Biomass and Waste | **K. Maniatis** |
| Wind Energy | **A. Kotronaros** |
| Mini-hydro | **H. Pauwels** |
| Photovoltaics | **B. Yordi** |
| Geothermal | **L. Stathakis** |
| Hydrocarbons | **M. Lombardini** |

European Commission
**THERMIE Activity Report 1998**
Luxembourg: Office for Official Publications of the European Communities
1998 – 44 pp. – 21 x 29.7 cm
ISBN 92-828-5650-X

## NOTICE TO THE READER

A great deal of additional information on the European Union is available on the Internet. It can be accessed through the Europa server (http://europa.eu.int).

12 15 CS-18-98-760-EN-C

OFFICE FOR OFFICIAL PUBLICATIONS
OF THE EUROPEAN COMMUNITIES
L-2985 Luxembourg

ISBN 92-828-5650-X

9 789282 856505